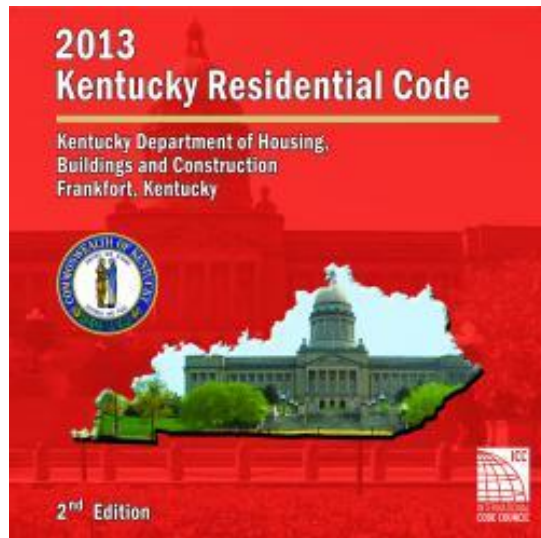


# Kentucky Energy Code Compliance Study



## Program Update

# Project Team

- George Mann (Project Manager)
- Larry Mahaffey (Circuit Rider)
- Isaac Elnecave/Chris Burgess/Kelsey Horton (MEEA)
- Roger Banks/Ric McNees (DHBC)
- Lee Colten /Michael Kennedy (DEDI)

# Overview of Project

**Purpose:** Determine if energy code compliance can be improved and how.

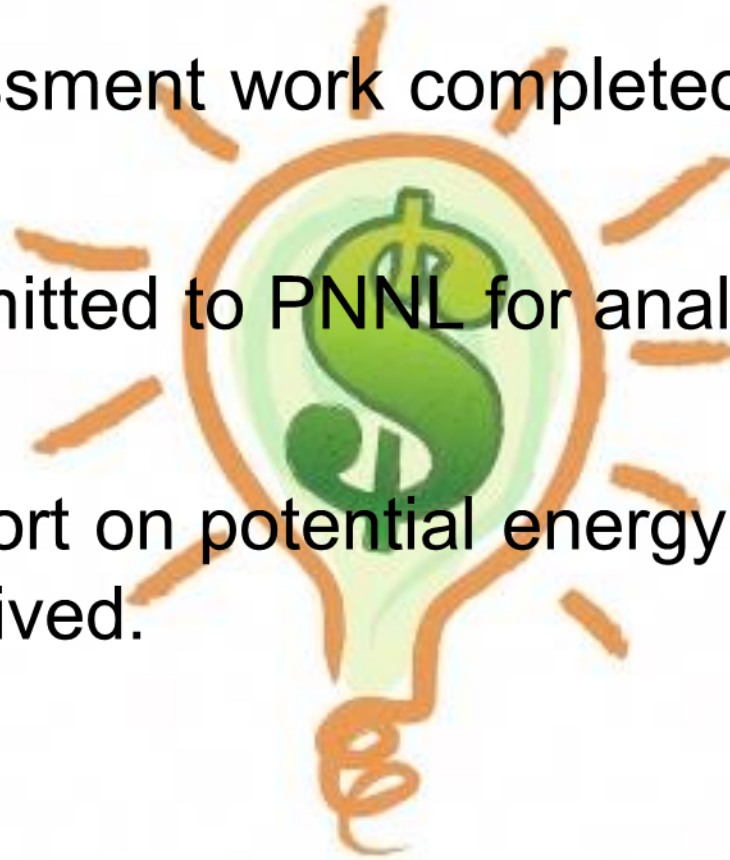
**Phase1:** Establish statewide level of code compliance.

**Phase 2:** Implement program – Circuit Rider program/Training & Education program.

**Phase 3:** Rerun code compliance study to determine level of improvement.

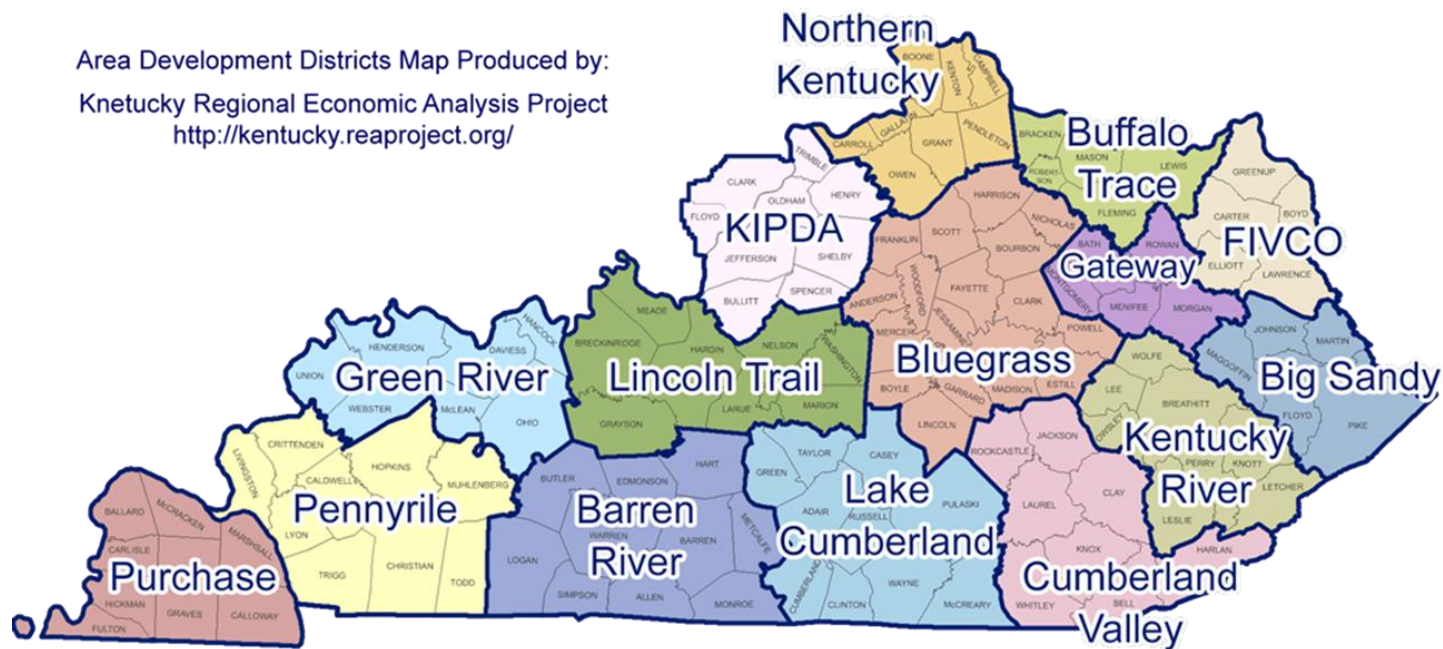
# Codes Assessment

- Site assessment work completed in August
- Data submitted to PNNL for analysis.
- PNNL report on potential energy savings has been received.



# Phase 2 Underway

- Larry Mahaffey, Circuit Rider, has been meeting with builders, contractors and building inspector since August 1



# Phase 2

## Larry's duties and responsibilities:

- Meet with builders, contractors, building inspectors to provide individual energy code assistance, advice, education
  - Distributing 2009 IECC
  - Distributing IECC Compliance Guides
  - Telling all about the Hotline address
  - Promote upcoming training opportunities
- Gain understanding of needs and obstacles regarding energy code construction and compliance
  - Assist in training development
  - Assists in formulation of ideas and materials to aid in and overcome energy related construction issues

# Phase 2



- **Southface**, an Atlanta based training provider, has been contracted to provide our onsite training
- 14 full day training sessions will be offered in 2016
- Serious possibility of offering more in 2017

# Phase 2

- Training Topics

- HVAC

- Air Sealing

- Field Observations



First classes to roll out week of April 18

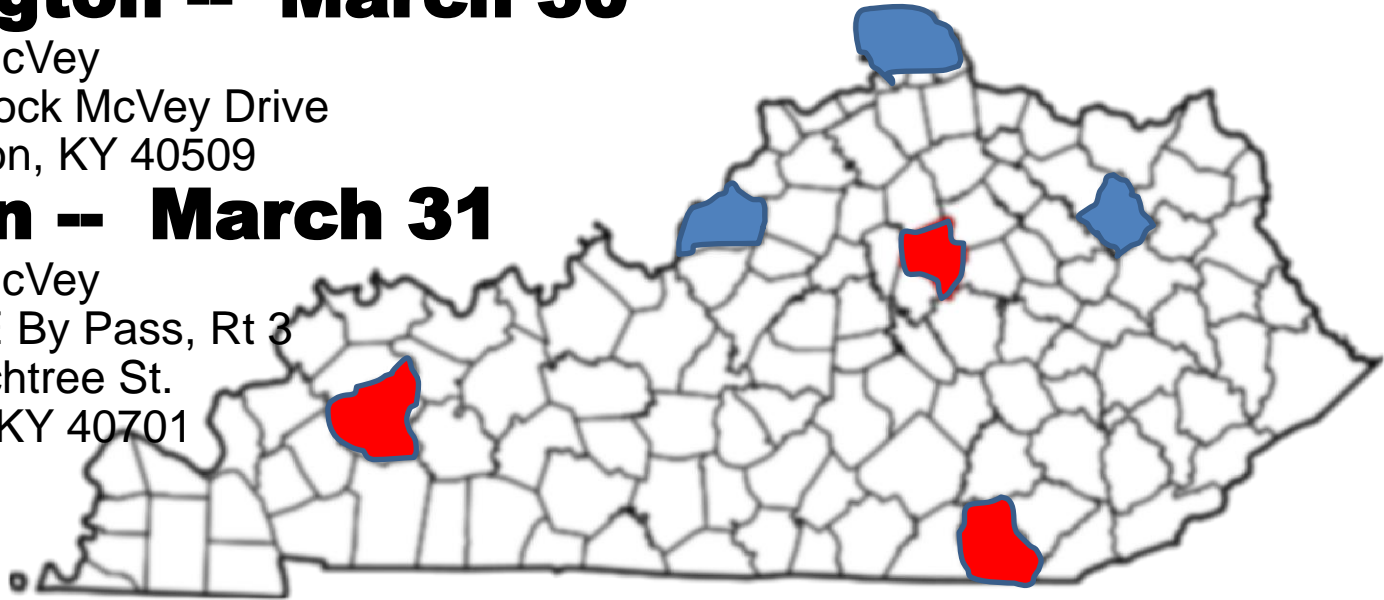


# Phase 2

- Offer online registration and paper registration
- Registration fee \$25
- Attendees will leave with 3-ring binder filled with valuable how-to Technical Guidelines relative to material presented in class

# Phase 2

- First 3 HVAC Classes Scheduled
  - **Madisonville -- March 28**  
Brothers Bar-B-Q  
1055 North Main Street  
Madisonville, KY 42431
  - **Lexington -- March 30**  
Brock McVey  
1100 Brock McVey Drive  
Lexington, KY 40509
  - **Corbin -- March 31**  
Brock McVey  
US 25 E By Pass, Rt 3  
71 Peachtree St.  
Corbin, KY 40701



# HVAC Training Content

## Learning Objectives:

- Identify code requirements regarding **sizing, design, and selection** of HVAC equipment and ducts
- Explain how the ACCA **Manual J, S and D** load calculation standards are used to determine appropriate sizing and design of ducts and HVAC equipment
- Describe the role the **HVAC system plays in moisture control** and the effect excessive moisture has on building durability and occupant comfort and health
- Define **sensible and latent heat**
- **Review a completed load calculation printout** for common errors and intentional inputs of incorrect data and identify examples of such errors
- **Compare installed HVAC and duct systems** to outputs of Manual J, S, and D to verify proper sizing and design
- Describe the consequences of **improperly sized HVAC systems**

# Air Sealing

- Sealing thermal envelope
- Lighting efficacy,
- Insulation installation,
- duct sealing,
- blower door testing,
- conditioned/unconditioned crawl space,
- Describe consequences if these items done improperly

## Potential AIR SEALING training sites across the state



# Current Projects in the Works

- HVAC Installation Data Collection -- Roger Banks
  - Evaluating equipment installation efficiency
- HVAC right sizing -- Chris Burgess
  - Evaluate correct equipment sizing from data collection
- Update ARRA Informational Pamphlets
- Online Learning Videos -- Kelsey Horton
- Review / Inspection checklist

# Update Informational Pamphlets

- 8 pamphlets developed under ARRA
- These pamphlets have been updated to insure current and accurate information and will be distributed / made available:
  - On-line
  - By Larry Mahaffey (Circuit Rider)
  - at all training classes
  - Hopefully at local building permit desk

# Online Videos

2013 krc - Bing | Kentucky Energy Codes

kyenergytraining.com/csect.php?S=1&L=10&C=17&M1=5

Add to the favorites bar by selecting ☆, or by getting them from another browser. [Import your favorites](#)

## and Construction

### Kentucky Energy Codes Online Training Center

In Person Training | Online Course Library

» Home » Online Training » Course Library » 2009 International Energy Conservation Code (2009 IECC) » Energy Codes: An Introduction & Background info

Kentucky Energy Codes Online Training Center | Course Library | 2009 International Energy Conservation Code (2009 IECC) » Energy Codes: An Introduction & Background info

kyenergytraining.com/flashpopup2m.php?S=1&L=10&C=17&M1=5&V=fm\_KY\_codes\_1\_intro.flv&P=kycode//data/swf/&T=Int

#### Introduction

### Acknowledgements

Kentucky Department for Energy Development and Independence

Kentucky Department for Housing, Buildings and Construction

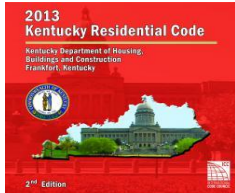
00:19

02:44 PM 1/15/2016

- 2009 International Energy Conservation Code (2009 IECC)
- Introduction & Background
- Structure of IECC
- The Energy Code: 2009 IECC
- Mandatory Compliance Requirements
- Building Thermal Envelope
- Air Leakage
- Ducts Inside Conditioned Space
- HVAC and Building Pressure
- Insulation Installation & Walls
- Roof/ Attics/ Above Grade Walls/ Floors
- Basements, Crawlspaces & Slabs
- Water and Moisture Issues
- Fenestration, Ducts & Electrical
- Compliance Software



# Review / Inspection Checklist



## Residential Energy Conservation Compliance 2013 KRC Plan Examiner / Field Inspector Checklist Kentucky is Climate Zone 4

Plan Examiner Name: \_\_\_\_\_ Date Reviewed: \_\_\_\_\_

Field Inspector Name: \_\_\_\_\_

Building Address: \_\_\_\_\_ City: \_\_\_\_\_ County: \_\_\_\_\_

Project Type: ☐ New Building ☐ Addition ☐ Renovation Condition Floor Area ft<sup>2</sup>: \_\_\_\_\_

Compliance Approach: ☐ Prescriptive (Section 401.2 #1) ☐ Performance (Section 401.2 #2) ☐ Total UA Alternative (Section 402.1.4)

Compliance Software Used (if not a prescriptive design): \_\_\_\_\_

Building Type: ☐ Single Family ☐ Duplex ☐ Townhouse ☐ Multiple Single Family

Foundation Type: ☐ Basement ☐ Slab ☐ Conditioned Crawl Space ☐ Floor Over Unconditioned Space

2009 IECC Section #	Plan Review	Prescriptive Code Requirement	Plan Design Value	Complies?	Field Confirmed Value	Complies?	Field Notes
403.6	Heating and cooling equipment	Sized per ACCA Manual S per loads determined by ACCA Manual J or other approved methods	Heating: Btu/hr: _____  Cooling: _____ SEER _____ Tons	<input type="checkbox"/> Complies <input type="checkbox"/> Does not comply <input type="checkbox"/> Not observable <input type="checkbox"/> NA	Heating: Btu/hr: _____  Cooling: _____ SEER _____ Tons	<input type="checkbox"/> Complies <input type="checkbox"/> Does not comply <input type="checkbox"/> Not observable <input type="checkbox"/> NA	
2009 IECC Section #	Foundation Inspection	Prescriptive Code Requirement	Plan Design	Complies?	Field Confirmed	Complies?	
T402.1.1	Slab edge insulation R-value	Unheated: R-10	R-_____	<input type="checkbox"/> Complies	R-_____	<input type="checkbox"/> Complies	

# Contact Information

- George Mann, Project Manager - [gmann@kyenergystudy.org](mailto:gmann@kyenergystudy.org)
- Larry Mahaffey, Circuit Rider – [lmahaffey@kyenergystudy.org](mailto:lmahaffey@kyenergystudy.org)
- Isaac Elnecave, MEEA – [ielnecave@mwalliance.org](mailto:ielnecave@mwalliance.org)
- Chris Burgess, MEEA – [cburgess@mwalliance.org](mailto:cburgess@mwalliance.org)
- Roger Banks, DHBC – [roger.banks@ky.gov](mailto:roger.banks@ky.gov)
- Ric McNees, DHBC – [ric.mcnees@ky.gov](mailto:ric.mcnees@ky.gov)
- Lee Colten, DEDI – [lee.colten@ky.gov](mailto:lee.colten@ky.gov)
- Michael Kennedy – [michael.kennedy@ky.gov](mailto:michael.kennedy@ky.gov)

# Questions?



# **Kentucky Energy Code Compliance Study**

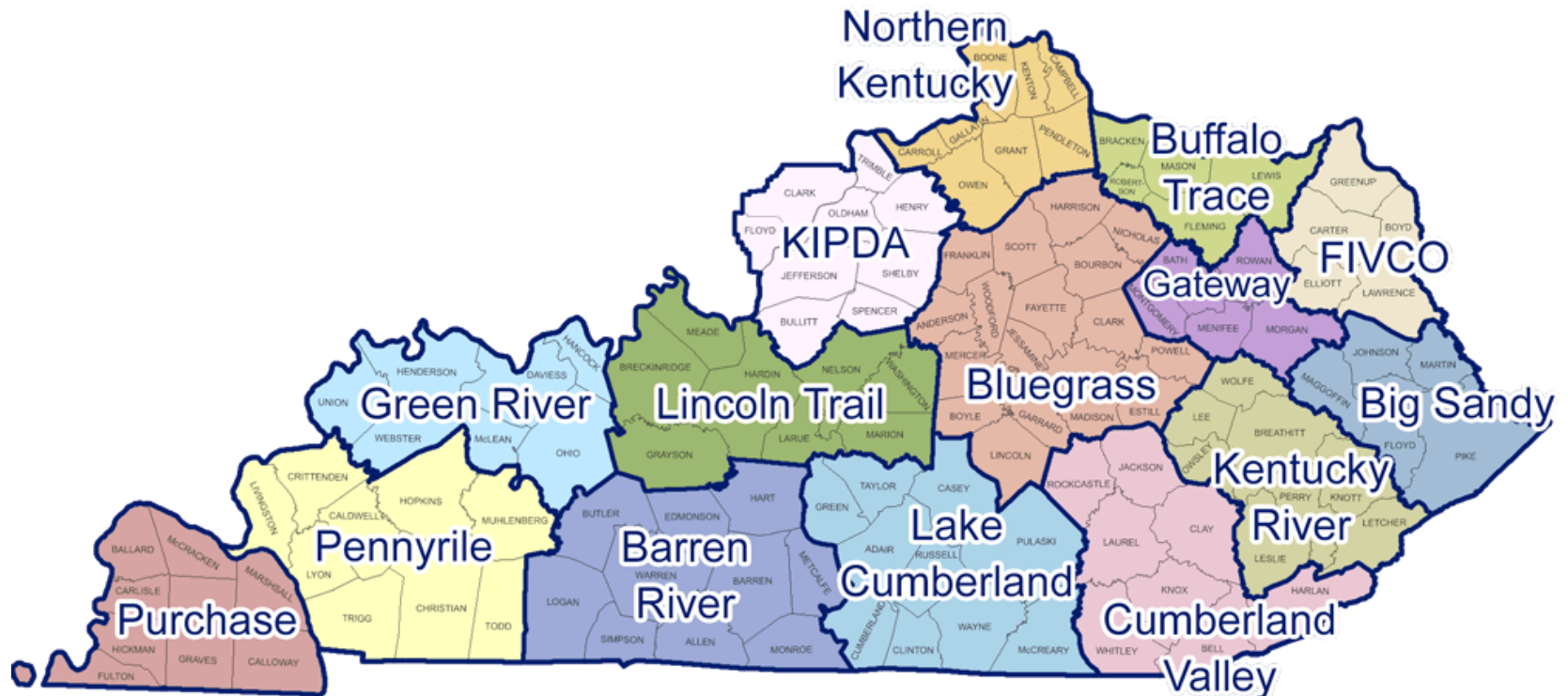
## **Circuit Rider Program**

**Larry Mahaffey**  
**Circuit Rider**  
**February 11, 2016**

# Introduction

- Biography
  - 9 years with DHBC as state building inspector
  - 40 years experience in construction field as carpenter, contractor, homebuilder, construction superintendent and building Inspector
- Circuit Rider Position
  - Started work on August 1, 2015
  - Provide individual assistance to code officials, builders and other energy code stakeholders
  - Pro-actively reach out to stakeholders on a regular basis
  - Establish a trusted energy code advisor relationship

# Circuit Rider Outreach



- Visits to Date: *Purchase, Pennyrile, Green River, Barren River, Lincoln Trail and KIPDA*
- Visits Next 3 months: *Barren River, Lincoln Trail, Lake Cumberland, KIPDA, Bluegrass and Northern Kentucky*
- Then continue to work eastward

# Circuit Rider Outreach

## Meetings/Contacts Conducted

- 44 Meetings to Date: 13 with homebuilders, 24 with inspection departments, 3 with HVAC contractors, 2 with Insulation contractors, 1 with a local fire chief / city clerk and 1 with a building supply business owner
- Meeting typically last from 30 – 120 minutes with 1 to 4 attendees
- Builders, contractors and code officials have generally been open to meetings and often willingly provide referrals
- Started conducting follow-up visits with previous contacts

# Circuit Rider Outreach

## Topics Discussed with Homebuilders

- Provide information on the Kentucky Energy Code Improvement Study, resources available, contact information and upcoming training opportunities.
- Discuss Prescriptive requirements of the 2009 IECC
- Air sealing; windows and doors, building seams & penetrations
- Equipment sizing and duct sealing
- Insulation installation; floors, walls, ceilings, basements, floor slabs and crawl spaces
- The use of insulation contractors and HERS raters
- The effects of positive and negative building pressure



# Circuit Rider Outreach

## Homebuilders Questions & Concerns

- Concerned that homes are being required to be built too tight
- What is the required basement insulation?
- Expressed concerns about radon contamination and what is the recommended method of mitigation
- Concerns that the application of codes are not being applied equally across the state
- Homes being built too tight may create unhealthy environment
- Homes built in counties without residential jurisdictions may not meet code
- Concerned with moisture buildup on building materials in conditioned crawlspaces during construction.

# Circuit Rider Outreach

## Topics Discussed With Building Officials

- Application and compliance issues with the 2009 IECC during plan review and inspection
- Prescriptive requirements of the 2009 IECC for residential construction
- Insulation installation and air sealing the envelope
- Basement, slab and crawl space insulation requirements
- Inspecting energy code requirements during routine inspections
- Checking energy certificate for correct information
- Providing code books, energy compliance handouts, soon to be released learning modules, future training opportunities and hotline information

# Circuit Rider Outreach

## Building Officials Questions & Concerns

- Is there a simple guide for plan review or inspection available
- Concerns with the use of spray foam in attic areas
- Inspectors believe builders use them as their code book, resulting in violations during code changes
- Uncertain whether homes are being built too tight
- Educating rural builders to the requirements of the energy code
- Builders contacting local government officials to avoid compliance
- Poor insulation installation on walk thru attic doors, chimney / fireplace chases and above tub / shower units

# Circuit Rider Outreach

## HVAC Contractors

- Topics
  - Air sealing, duct sealing and system sizing
  - Humidity levels in homes
  - Conditioned crawl space vs. vented unconditioned crawl space
  - Ventilation systems being used
  - Effects of positive and negative building pressure
  - Programmable thermostats
- Questions & Concerns
  - System sizing for future homeowner additions
  - Bidding against competitors using thinner gauge ductwork than required

# Circuit Rider Outreach

## Insulation Contractors

- Topics
  - Air sealing and insulation installation
  - The use of spray foam insulation and ignition barriers
  - Training of insulation company employees
  - General prescriptive requirements of the 2009 IECC
- Questions & Concerns
  - Expressed concern that some inspectors are not informed on spray foam products and the application of ignition barriers.

# Contact Information

Larry Mahaffey

(502) 645-6542

[lmahaffey@kyenergystudy.org](mailto:lmahaffey@kyenergystudy.org)

Energy Code Hotline:

[energycodehotline@kyenergystudy.org](mailto:energycodehotline@kyenergystudy.org)

Website: [www.kyenergystudy.org](http://www.kyenergystudy.org)

# Questions?

## Kentucky: PNNL - Statewide Measure by Measure Energy Savings

Measure	Total Electricity Savings (kWh)	Total Natural Gas Savings (therms)	Total Energy Savings (MMBtu)	Total Electricity Savings	Total Natural Gas Savings	Total Energy Cost Savings
Wall - PNNL	1,199,555	51,841	9,277	\$117,436	\$53,608	\$171,044
Lighting - PNNL	2,206,514	(17,865)	5,742	\$216,018	(\$18,473)	\$197,544
ACH 50 - PNNL	3,245,622	161,079	27,182	\$317,746	\$166,568	\$484,314
Duct Leakage - PNNL	444,934	13,060	2,824	\$43,559	\$13,505	\$57,064
<b>TOTAL</b>	<b>7,096,625</b>	<b>208,115</b>	<b>45,025</b>	<b>\$694,759</b>	<b>\$215,208</b>	<b>\$909,966</b>



# Online Training Modules

- Introduction & Background
- Structure of IECC
- The Energy Code: 2009 IECC/2013 KRC
- Mandatory Compliance Requirements
- Building Thermal Envelope
- Air Leakage
- Duct Installation & Duct Sealing
- HVAC and Building Pressure
- Insulation Installation & Walls
- Roof/Attics/Above-Grade Walls/Floors
- Basements/Crawlspaces & Slabs
- Water & Moisture Issues
- Fenestration, Ducts, & Electrical
- Compliance Software

# Online Training Modules

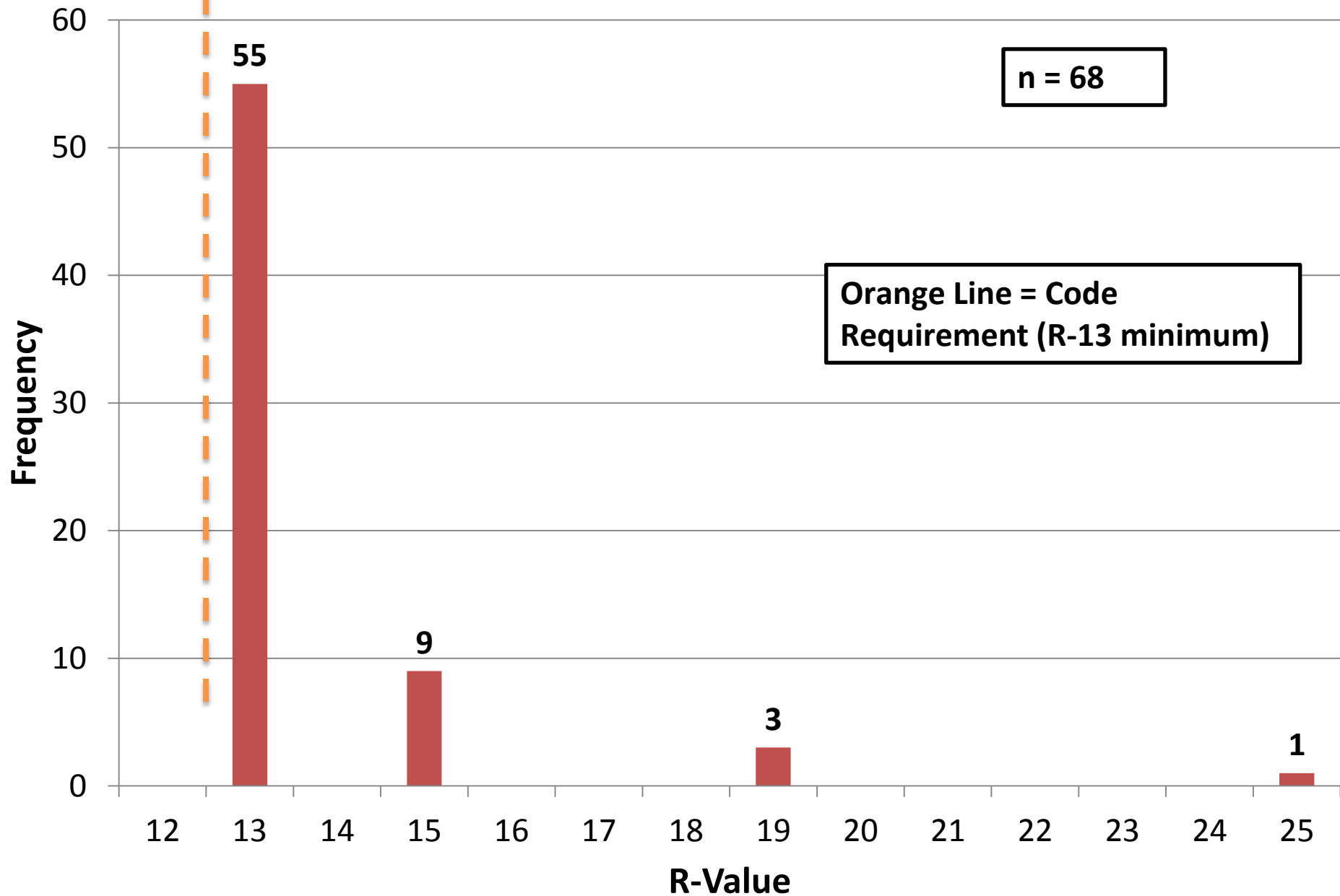
- Example Video Clip -  
Water and Moisture  
Issues:  
<http://bit.ly/1Rn76KJ>

# Online Training Modules – Next Steps

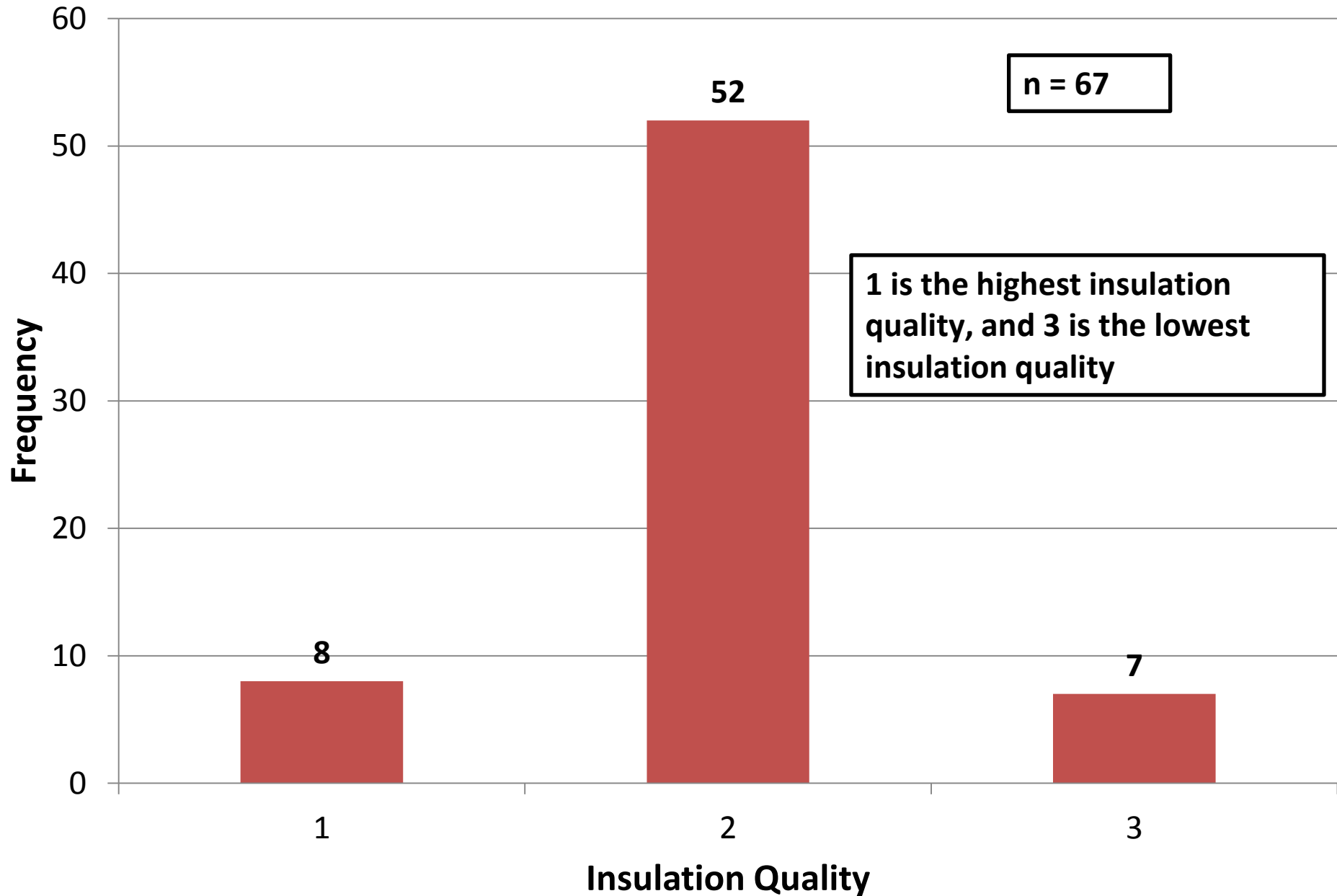
- Mid-March: Receive drafts of all videos from BMI and review for approval
- Upon approval: Post to YouTube channel for public access
- Larry will use these videos in Circuit Rider outreach activities

# Alabama Histograms

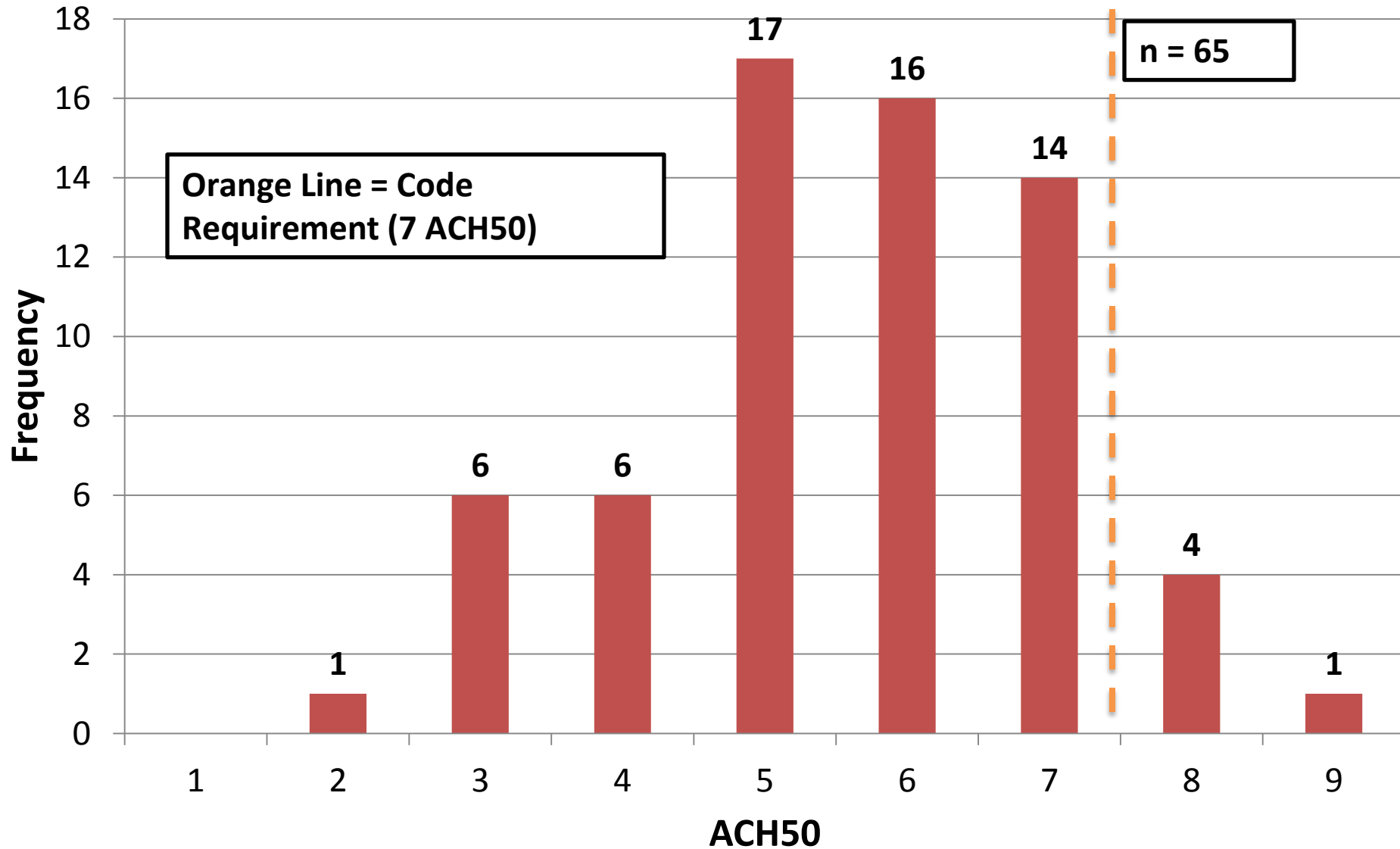
# Alabama Wall Insulation - R-Value



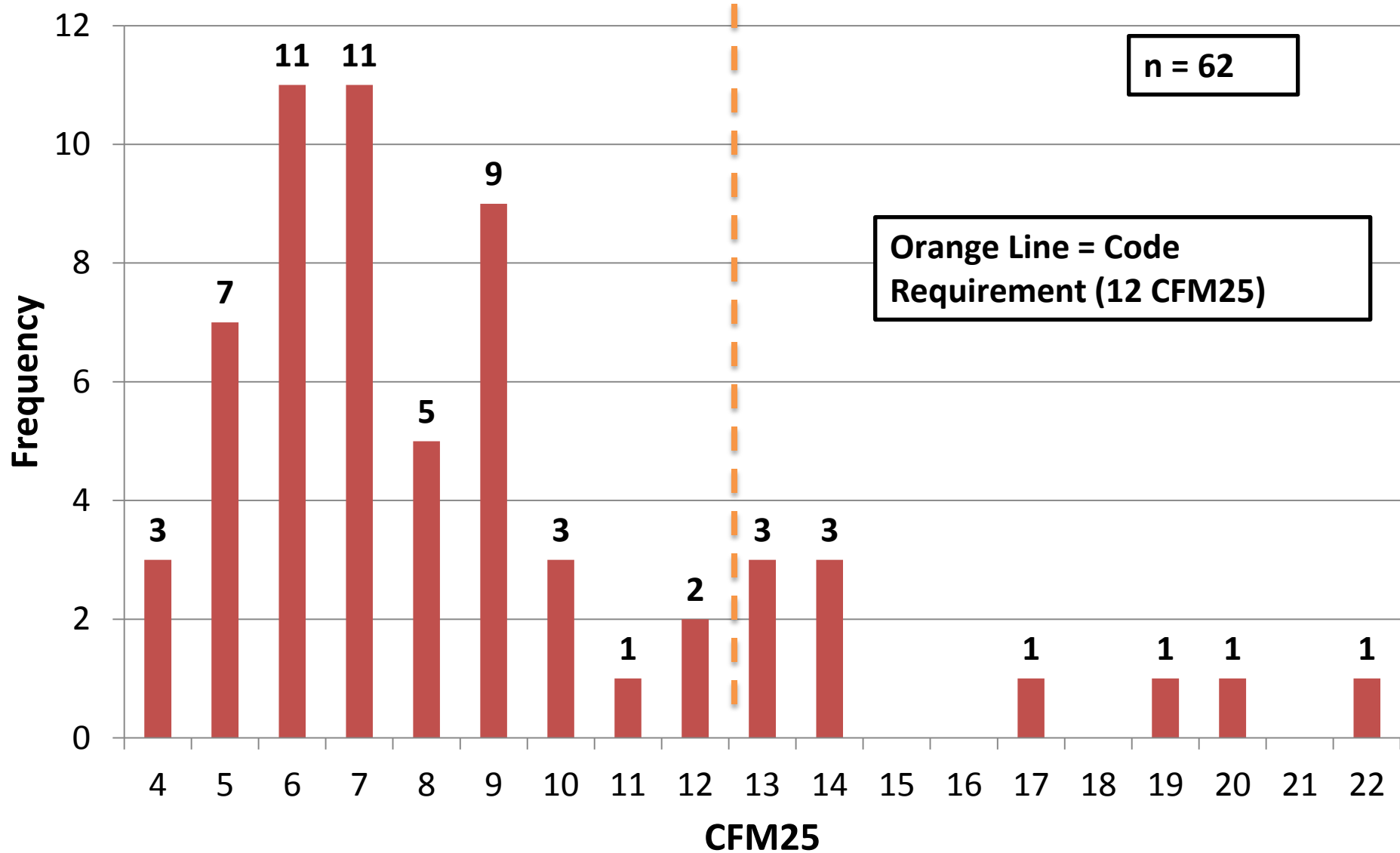
# Alabama Wall Insulation - Quality



# Alabama Blower Door Results (ACH50)

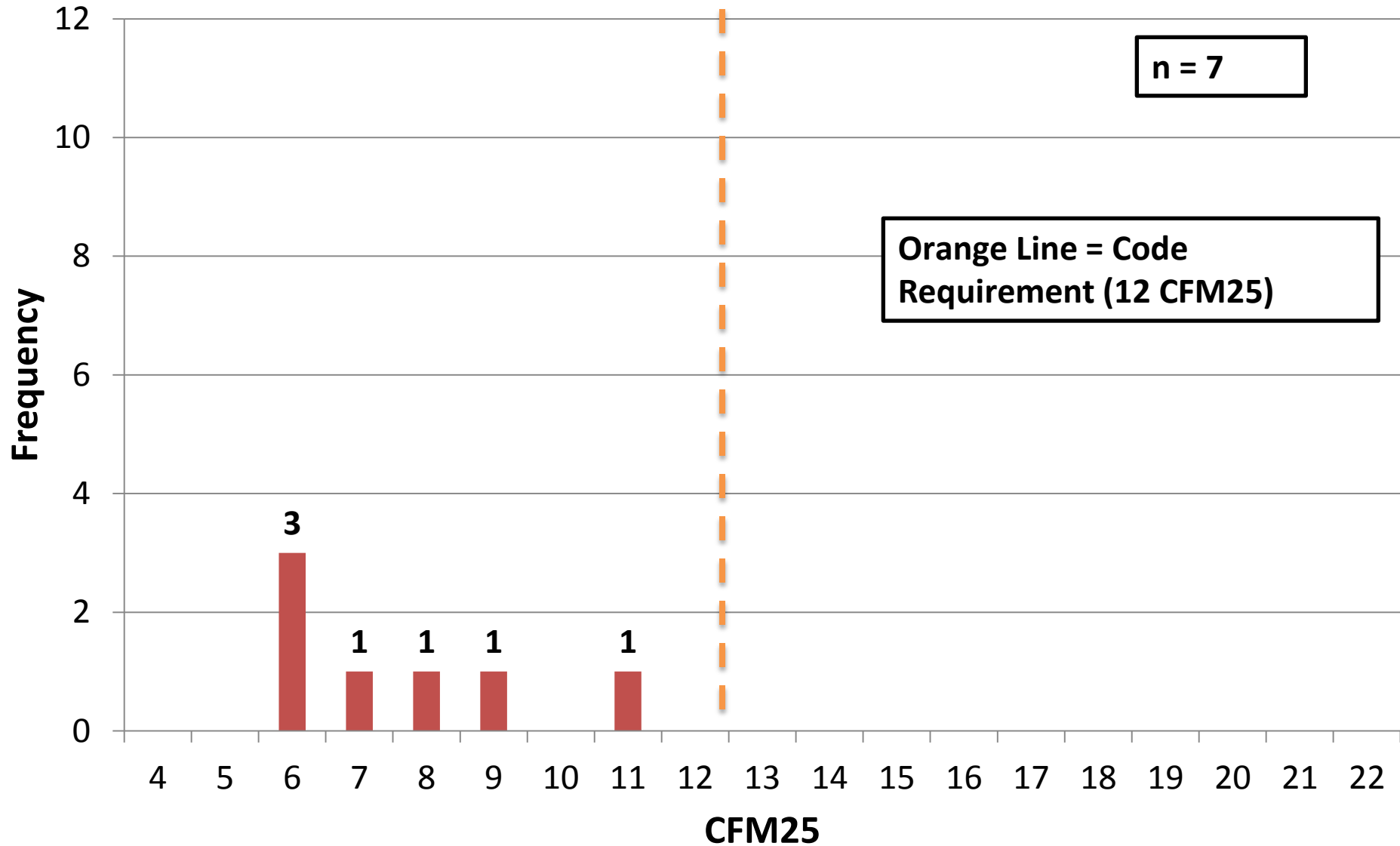


# Alabama Duct Leakage - Unconditioned Space

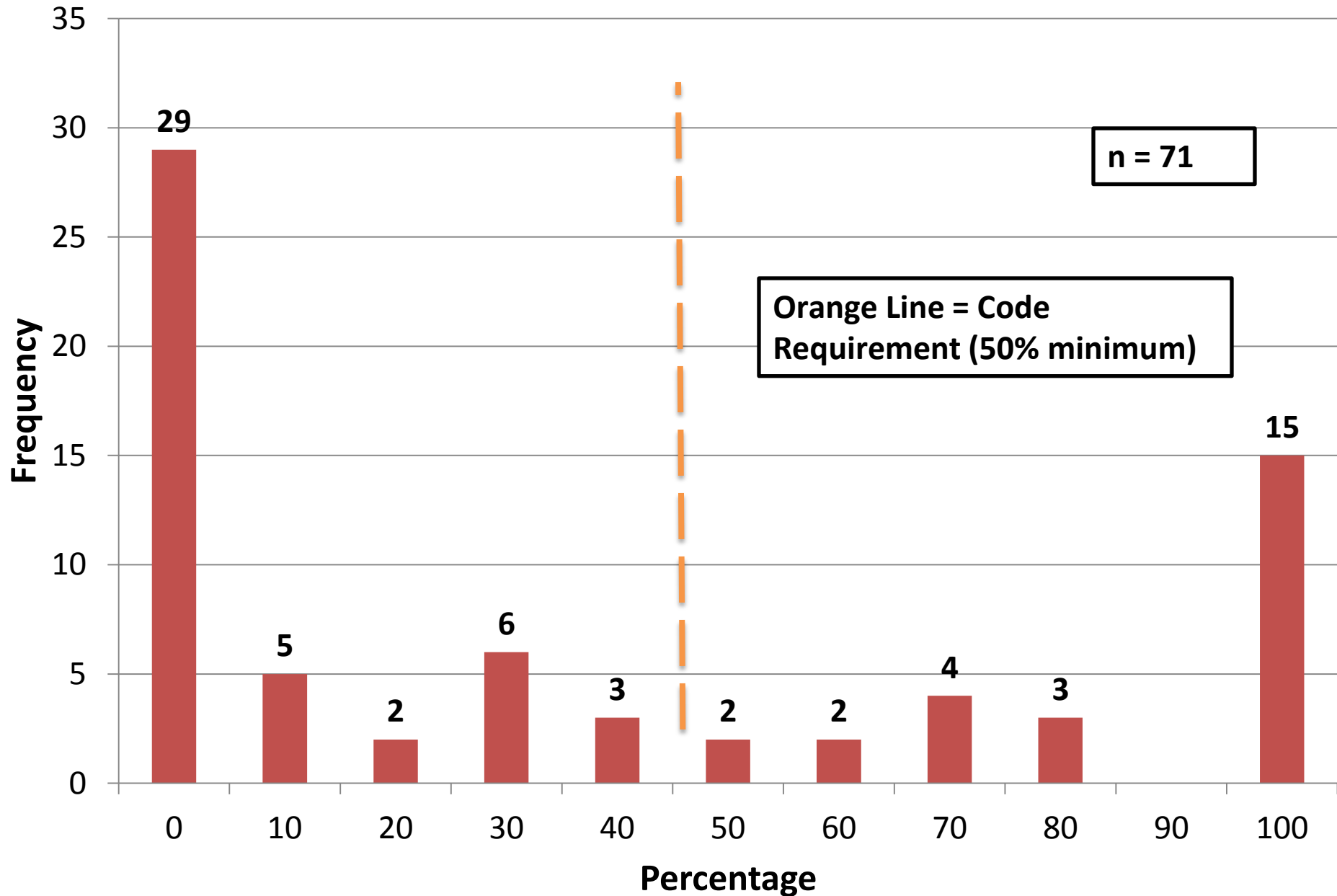




# Alabama Duct Leakage – Conditioned Space

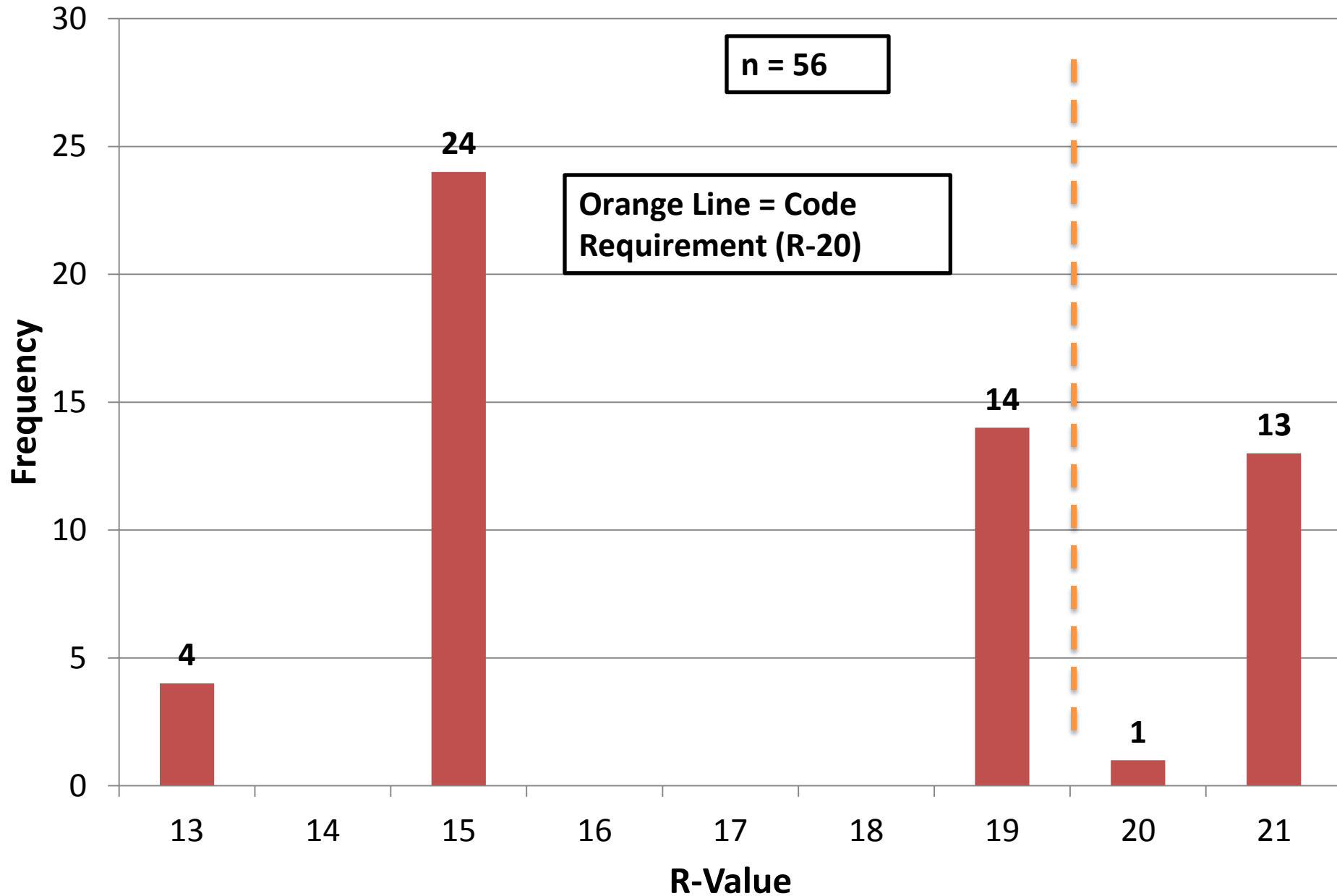


# Alabama - High Efficacy Lighting (%)

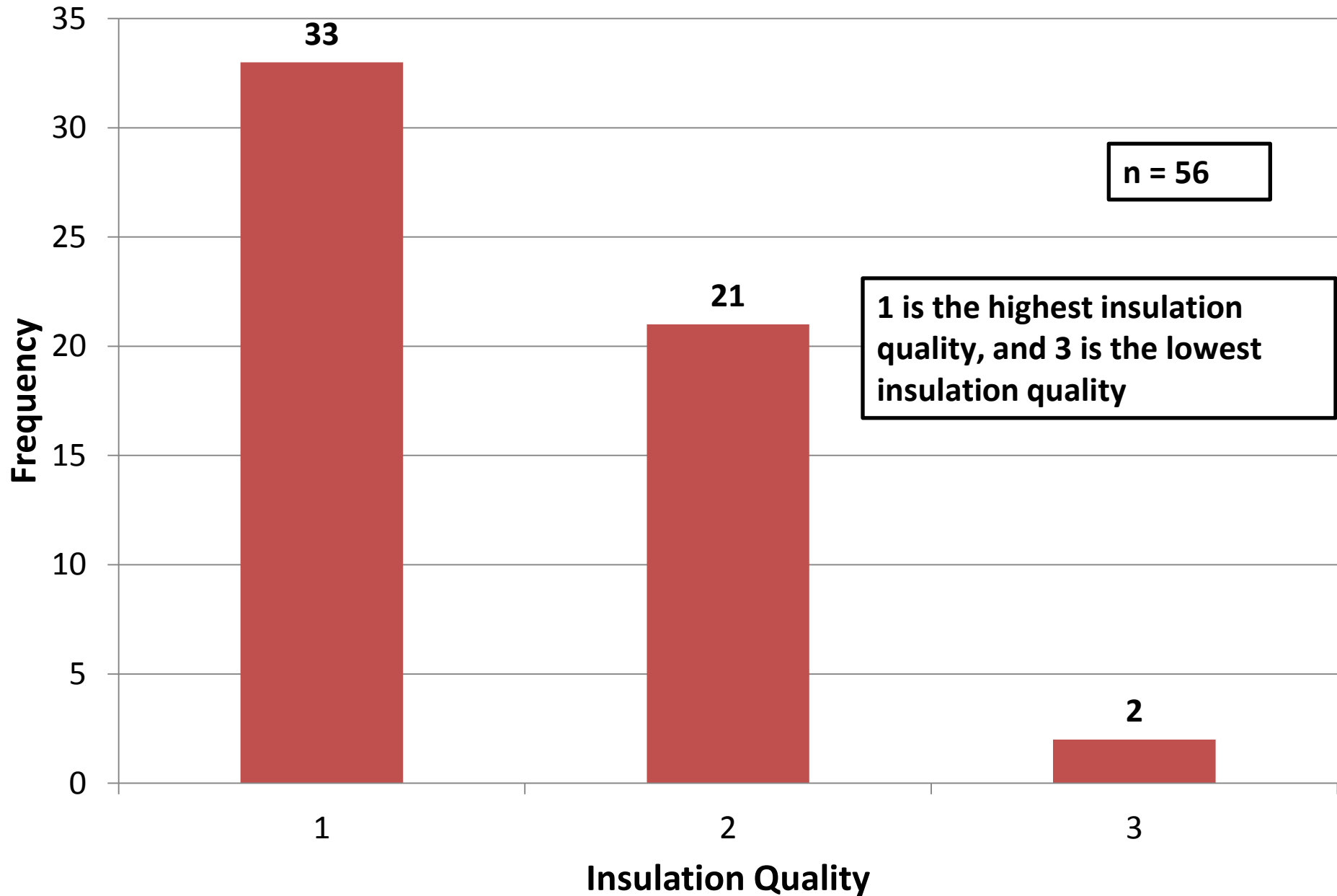


# **Maryland Histograms**

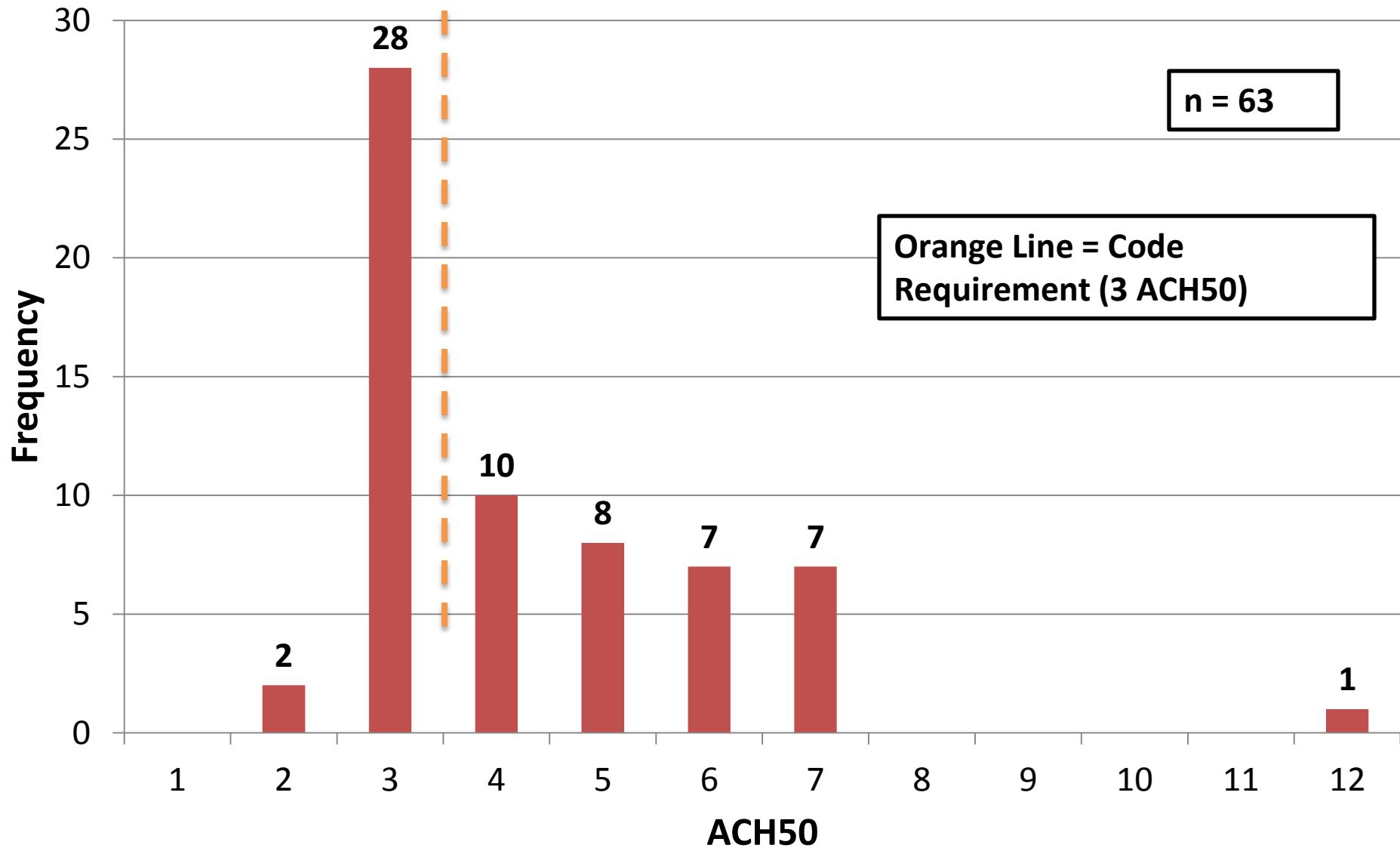
# Maryland Wall Insulation - R-Value



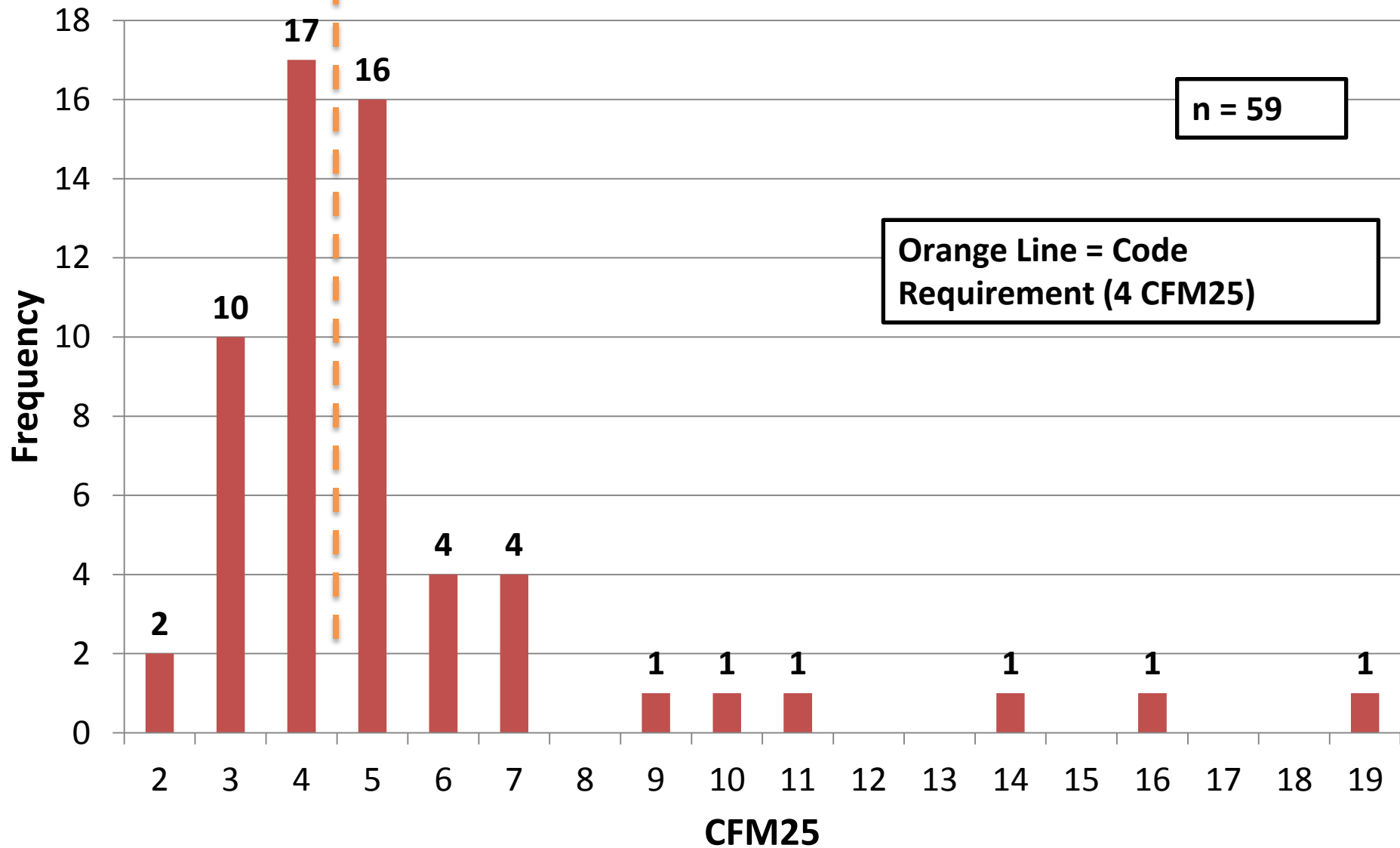
# Maryland Wall Insulation - Quality



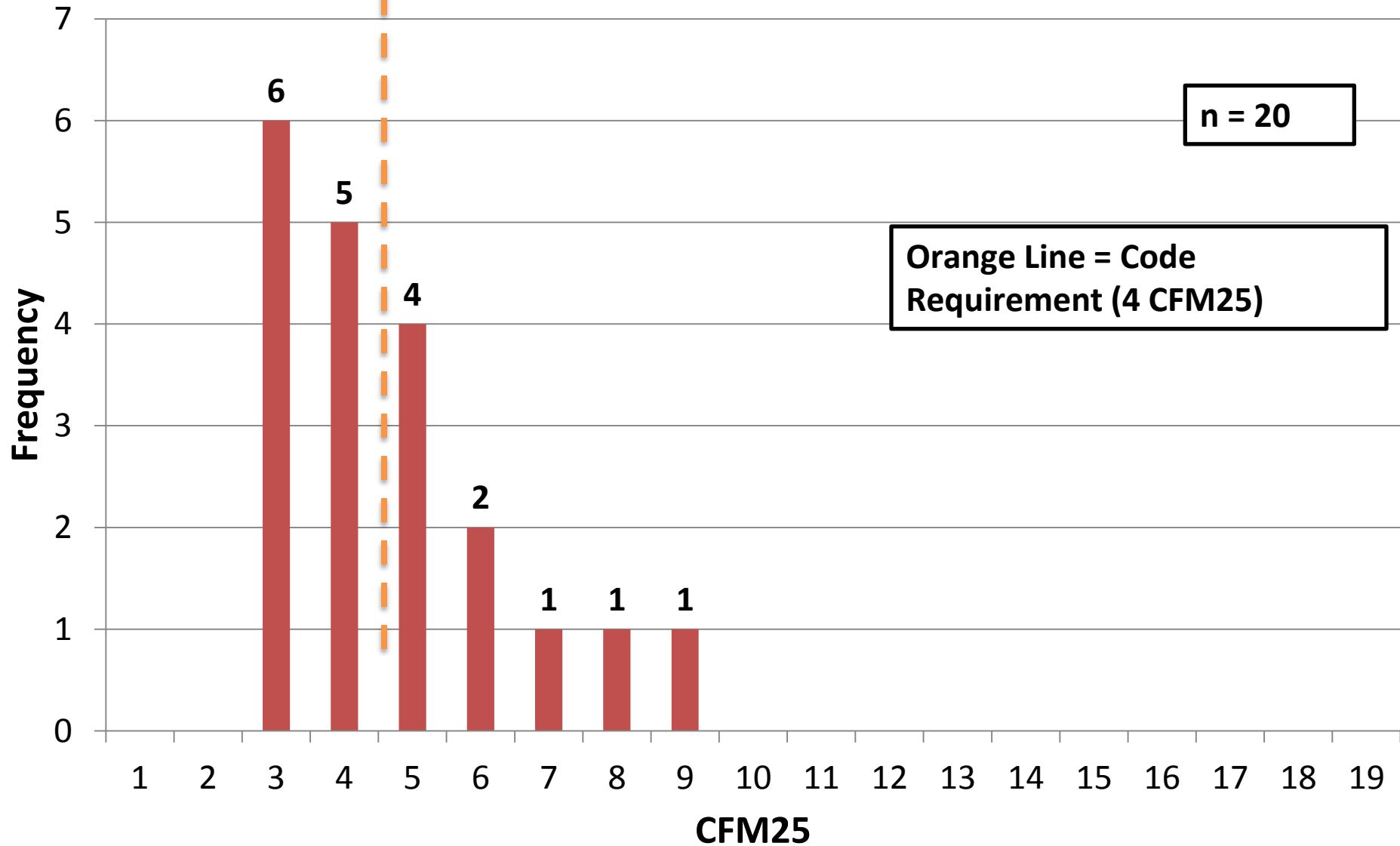
# Maryland Blower Door Results (ACH50)



# Maryland Duct Leakage - Unconditioned Space

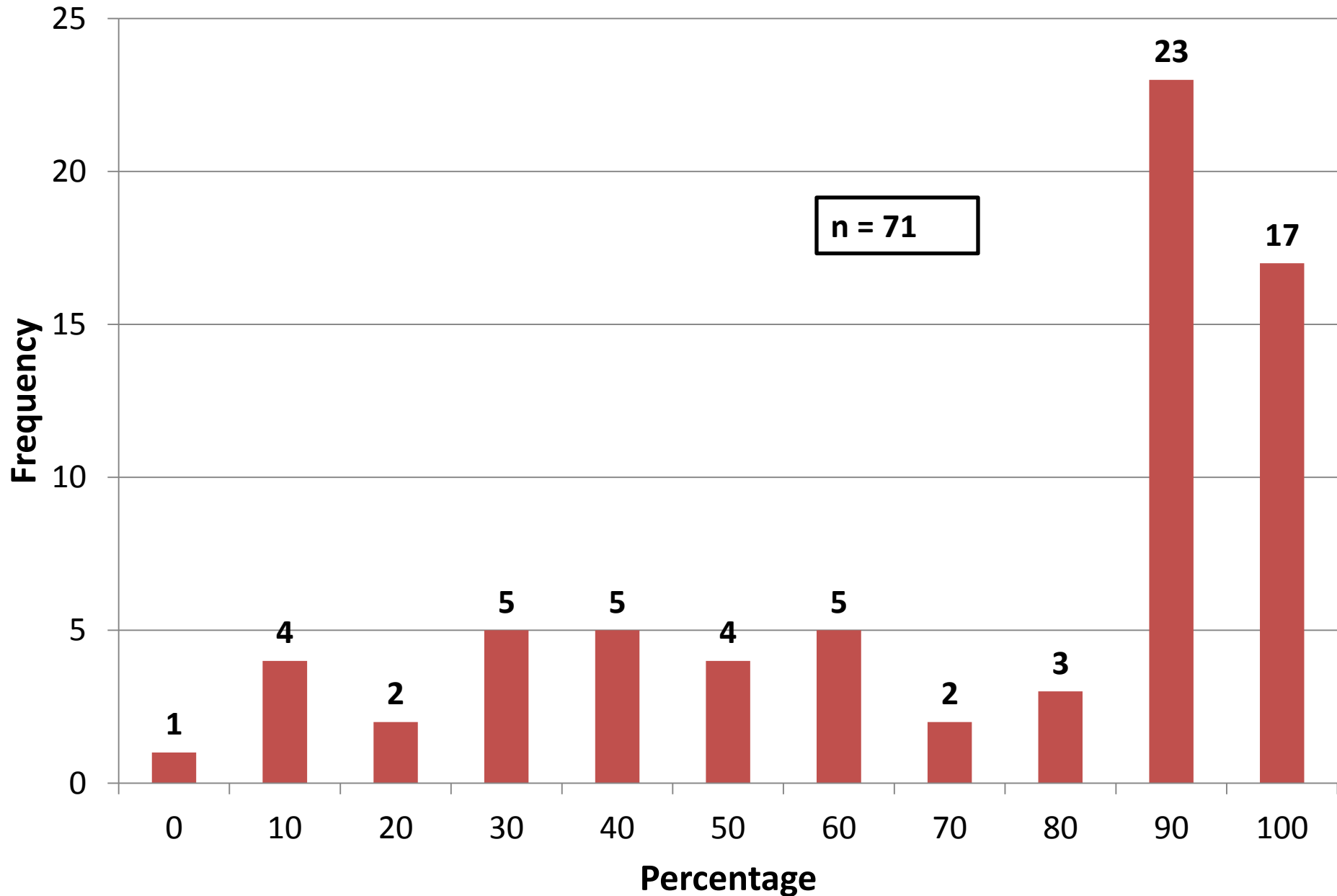


# Maryland Duct Leakage - Conditioned Space



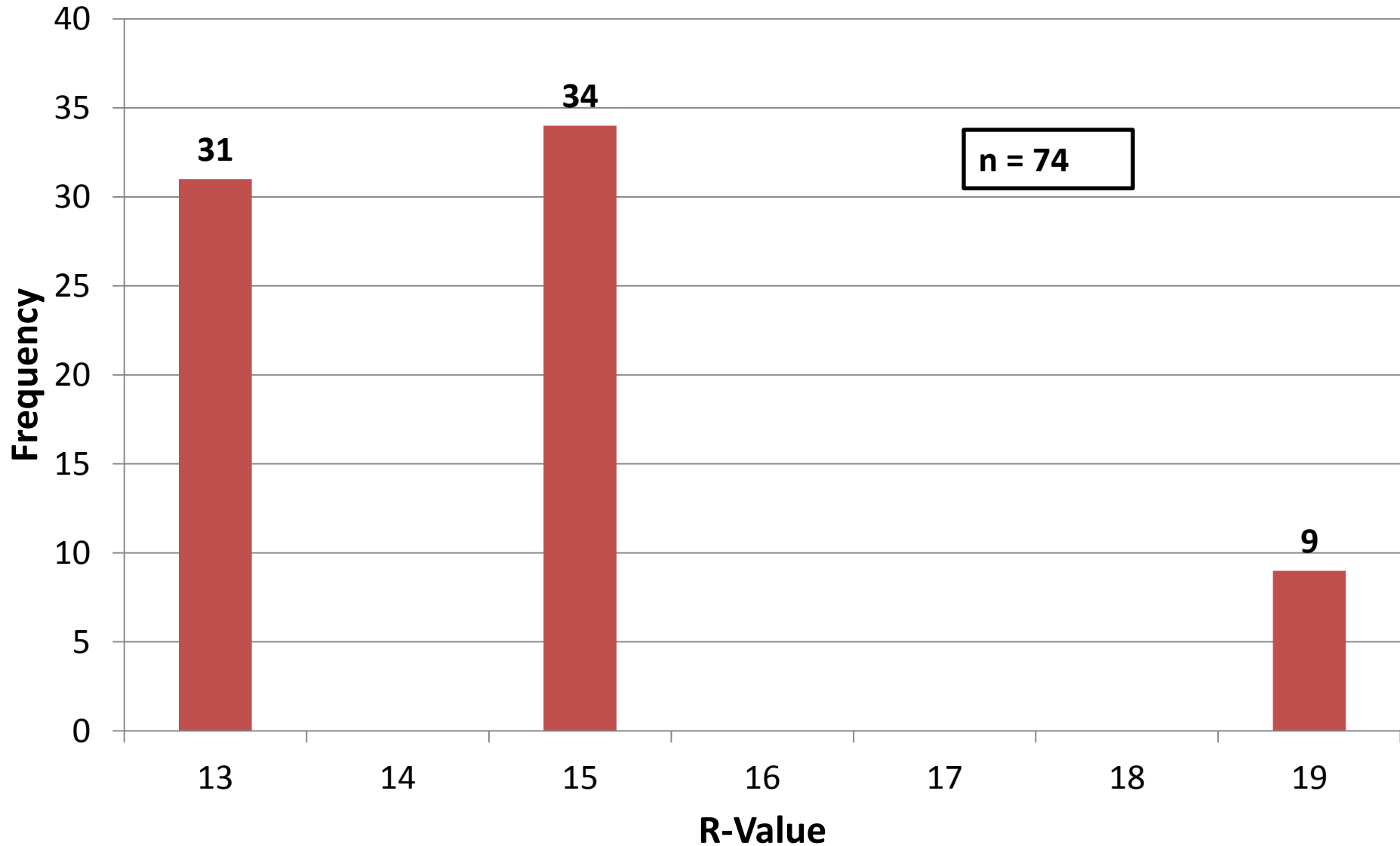


# Maryland - High Efficacy Lighting (%)

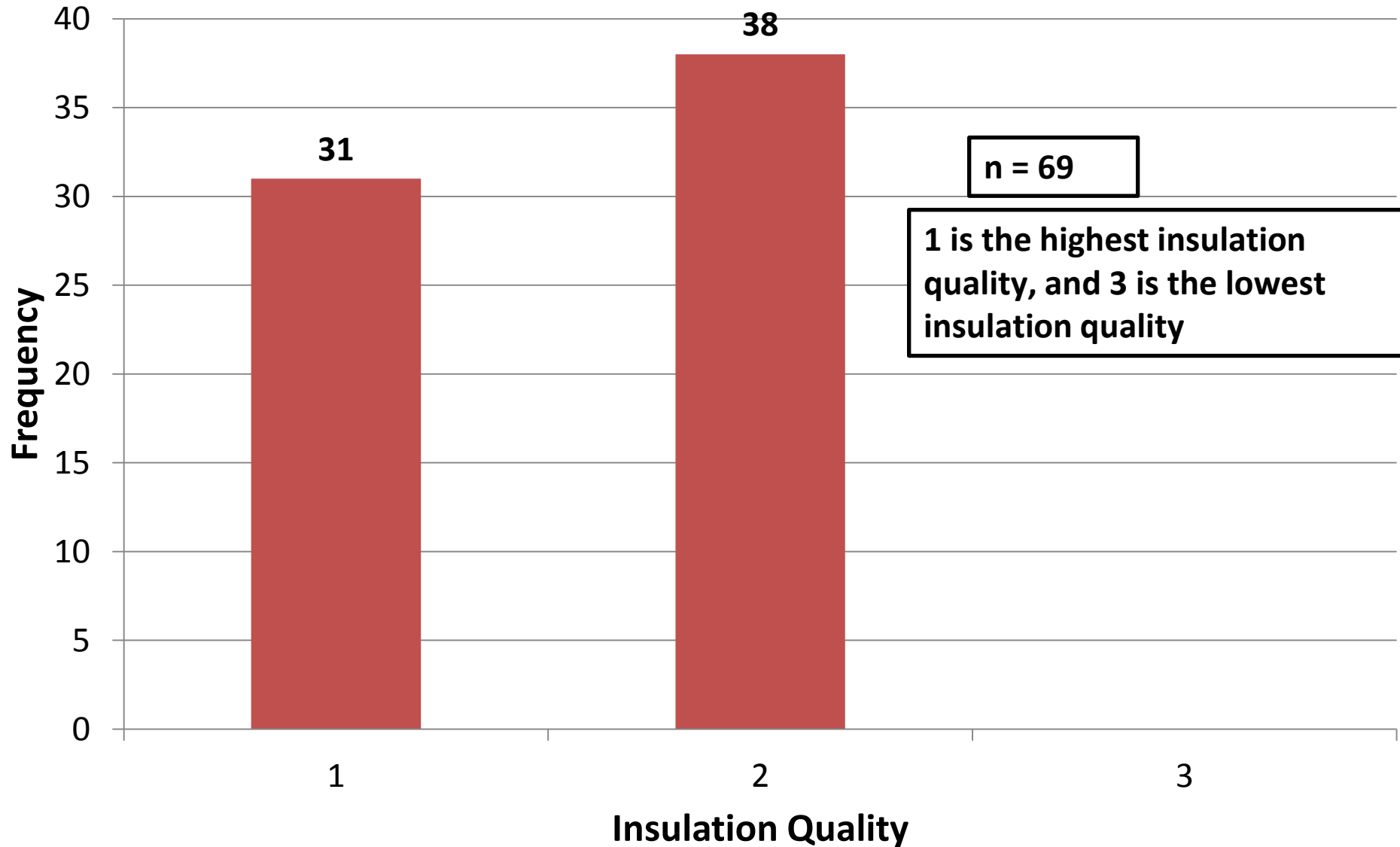


# **North Carolina Histograms**

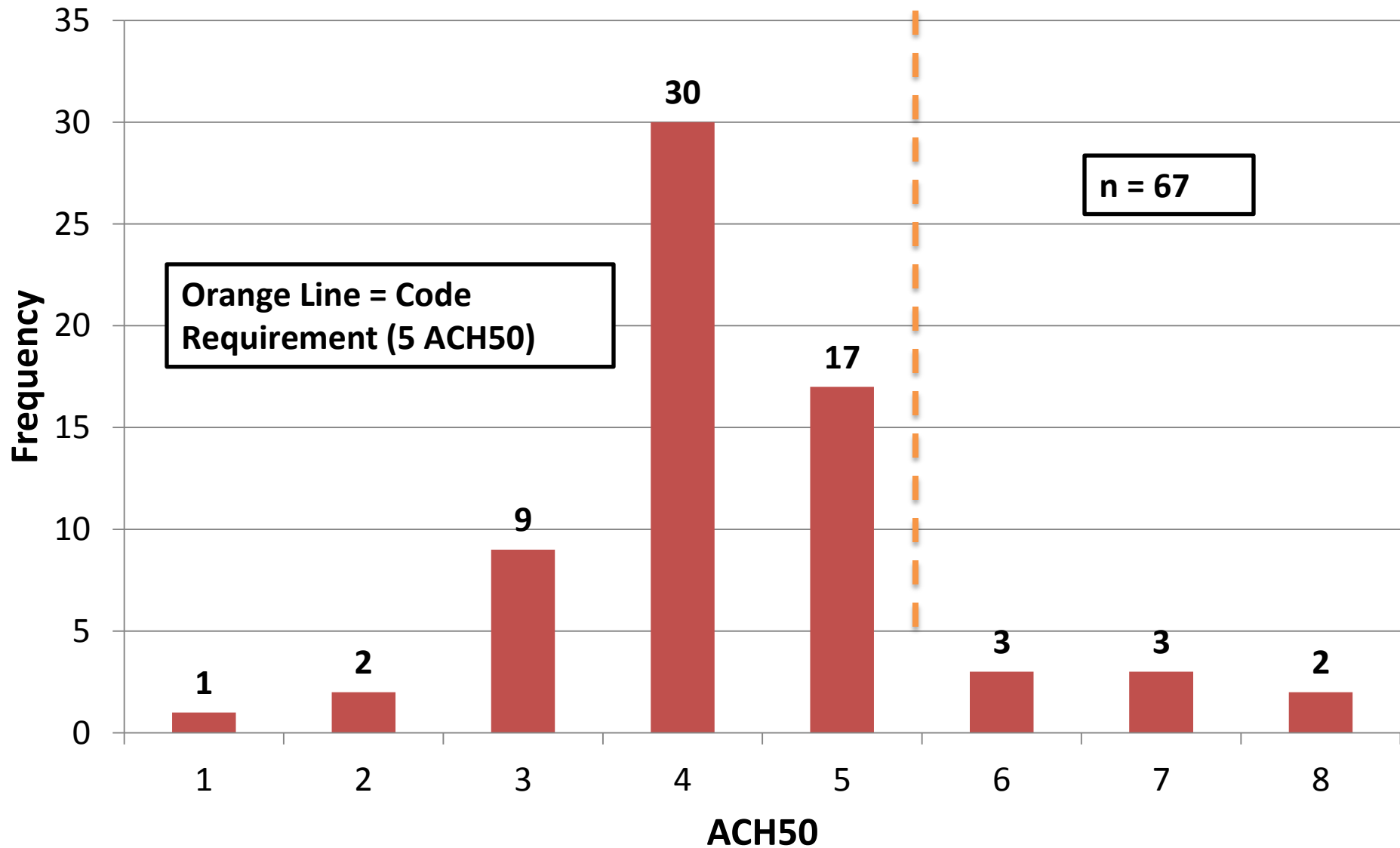
# North Carolina Wall Insulation - R-Value



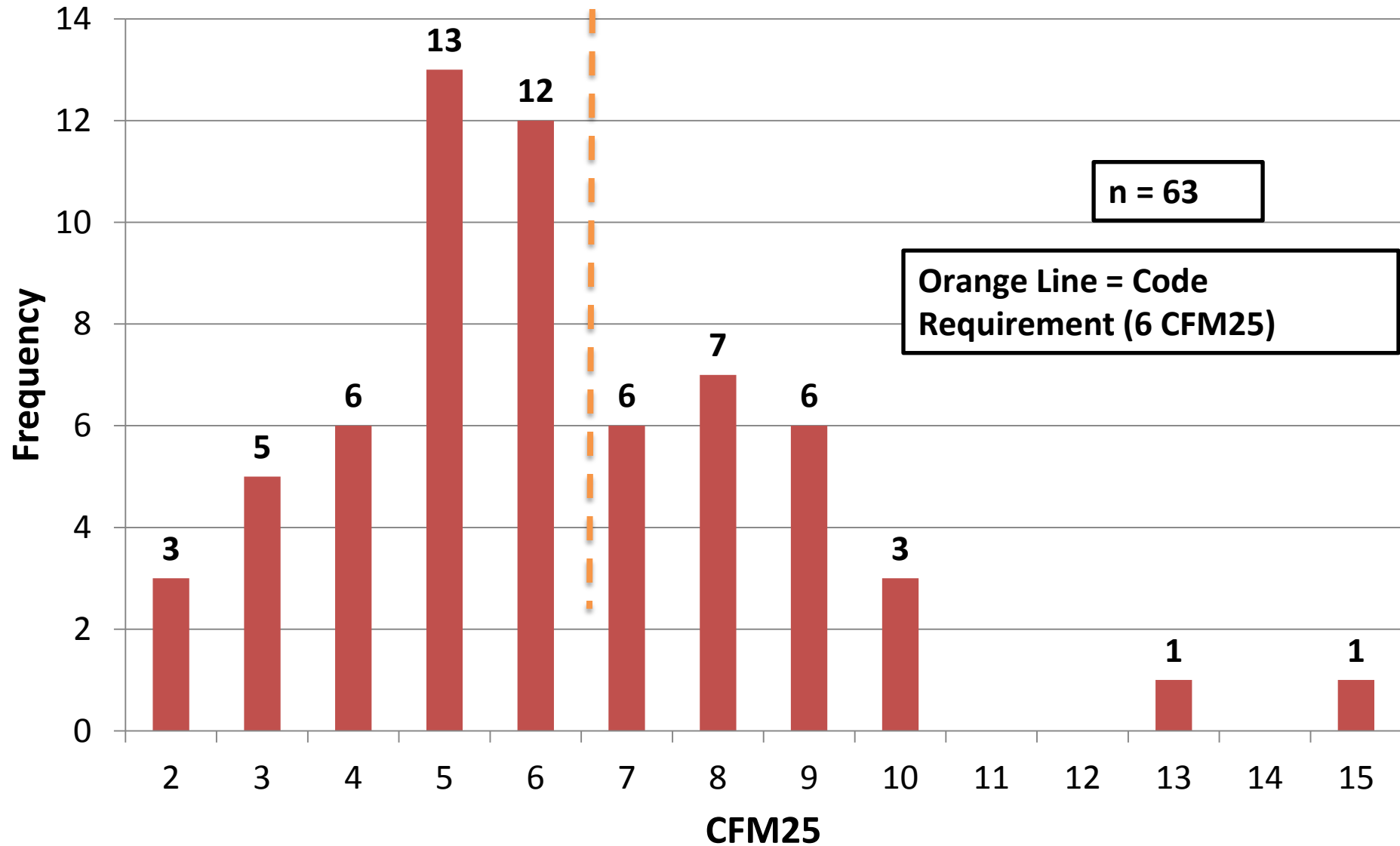
# North Carolina Wall Insulation - Quality



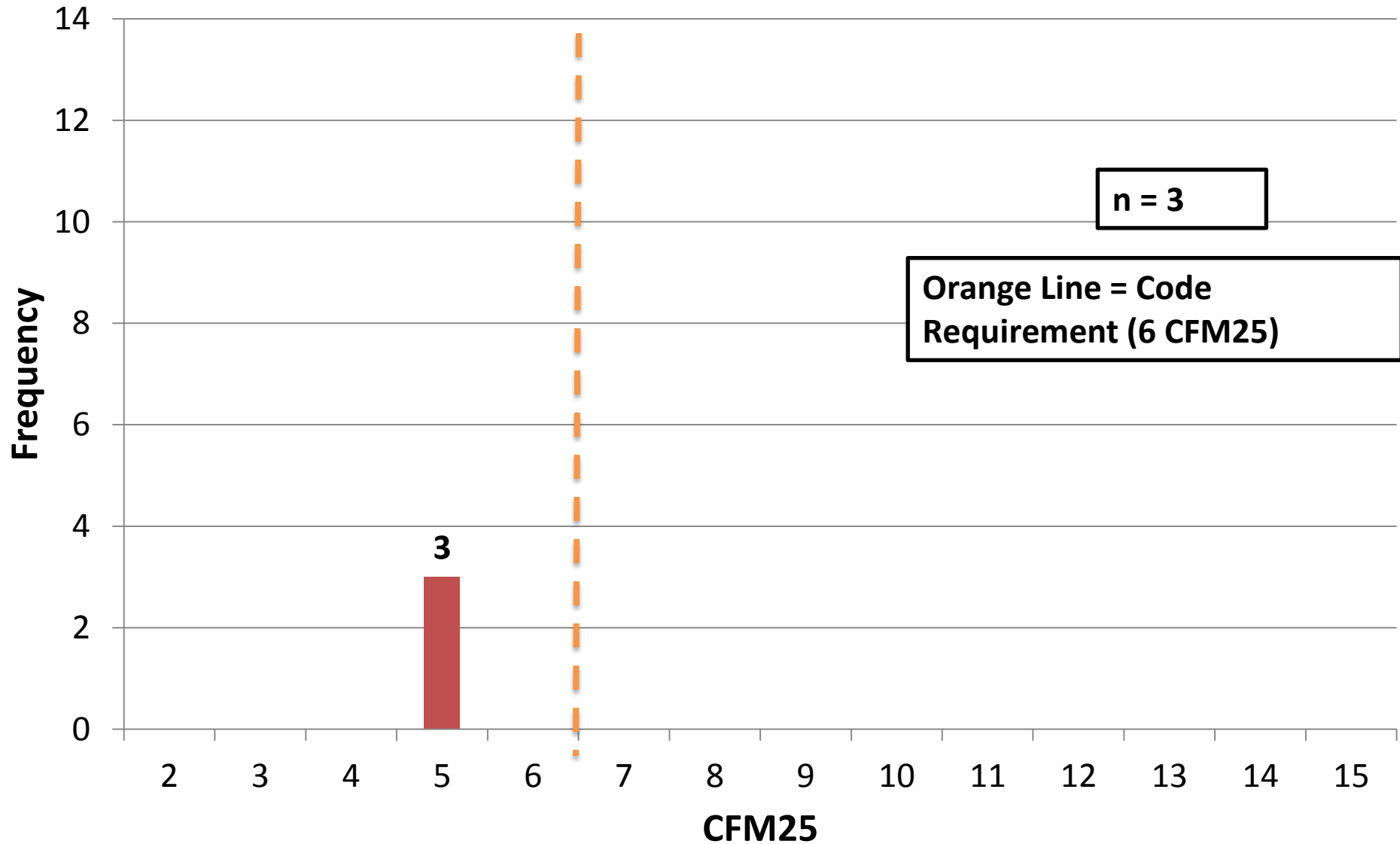
# North Carolina Blower Door Results (ACH50)



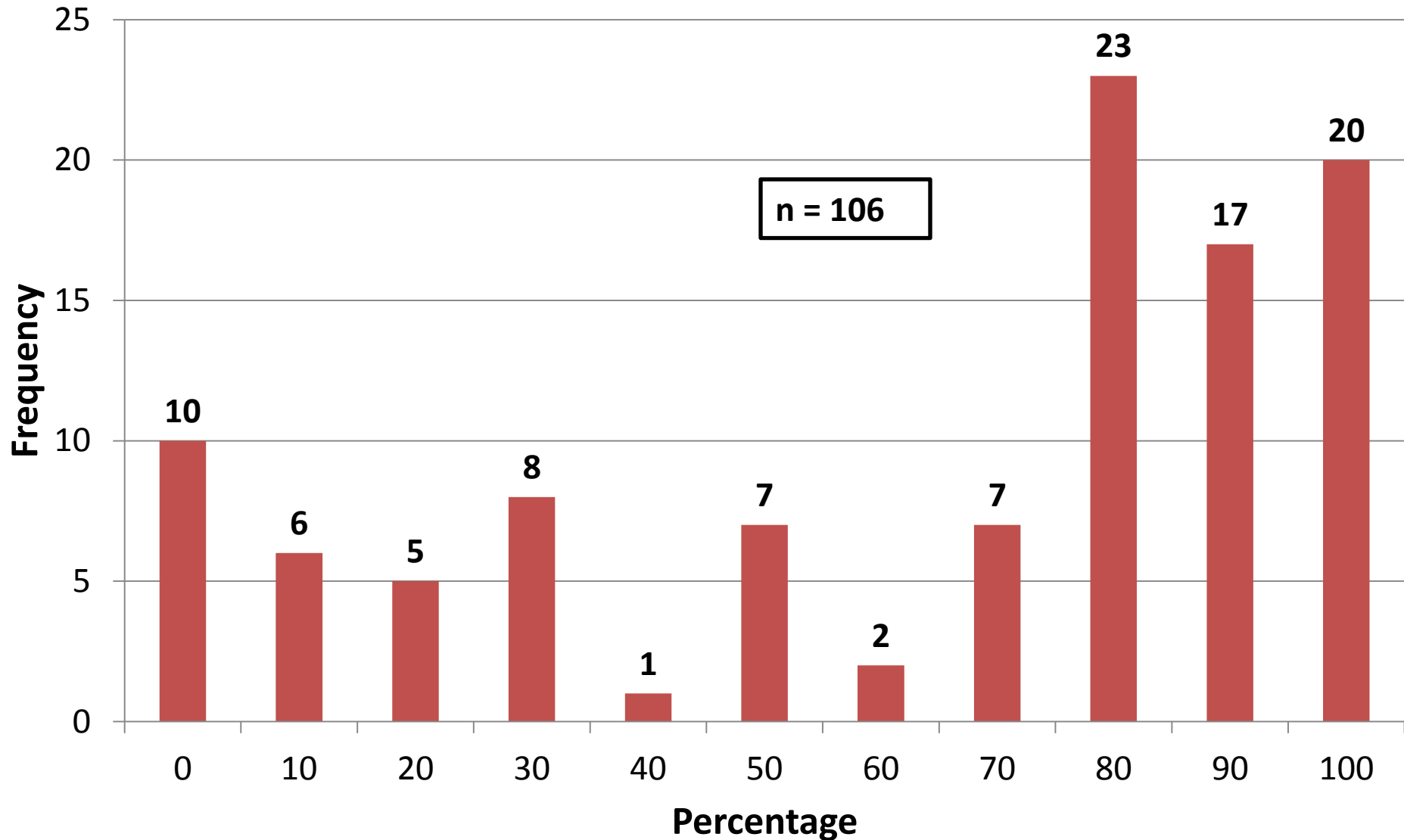
# North Carolina Duct Leakage - Unconditioned Space



# North Carolina Duct Leakage - Conditioned Space



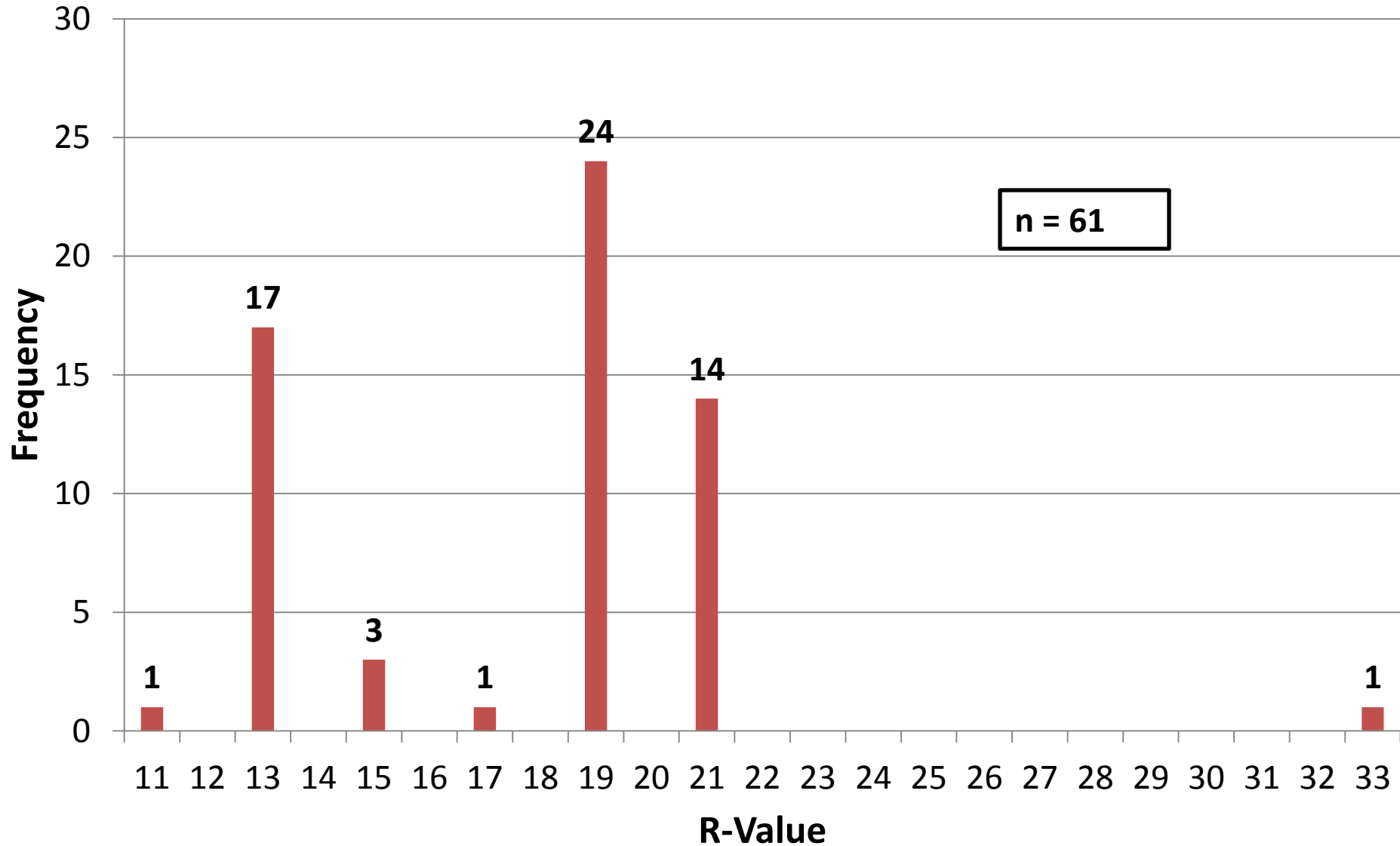
# North Carolina - High Efficacy Lighting (%)



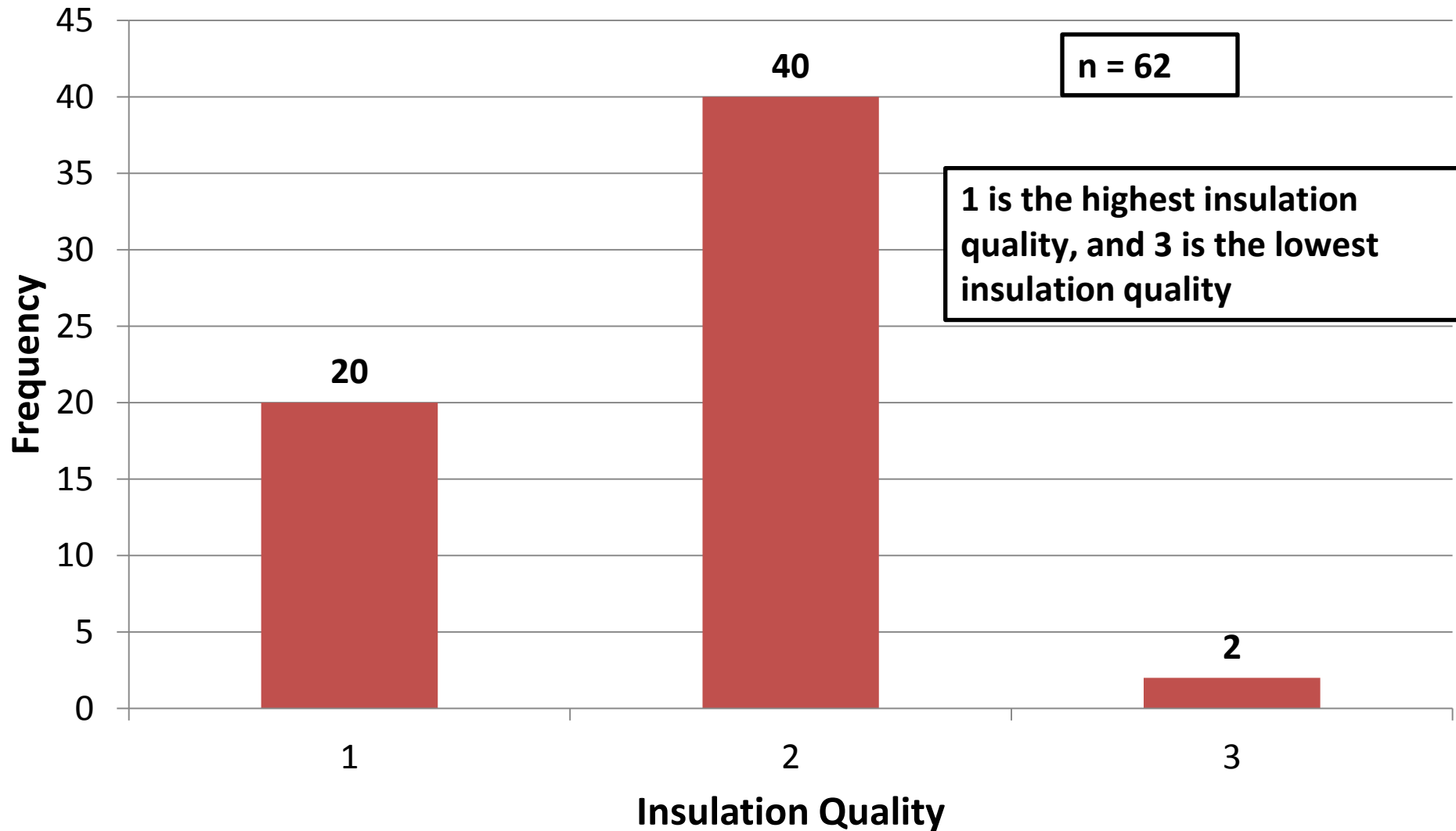


# **Pennsylvania Histograms**

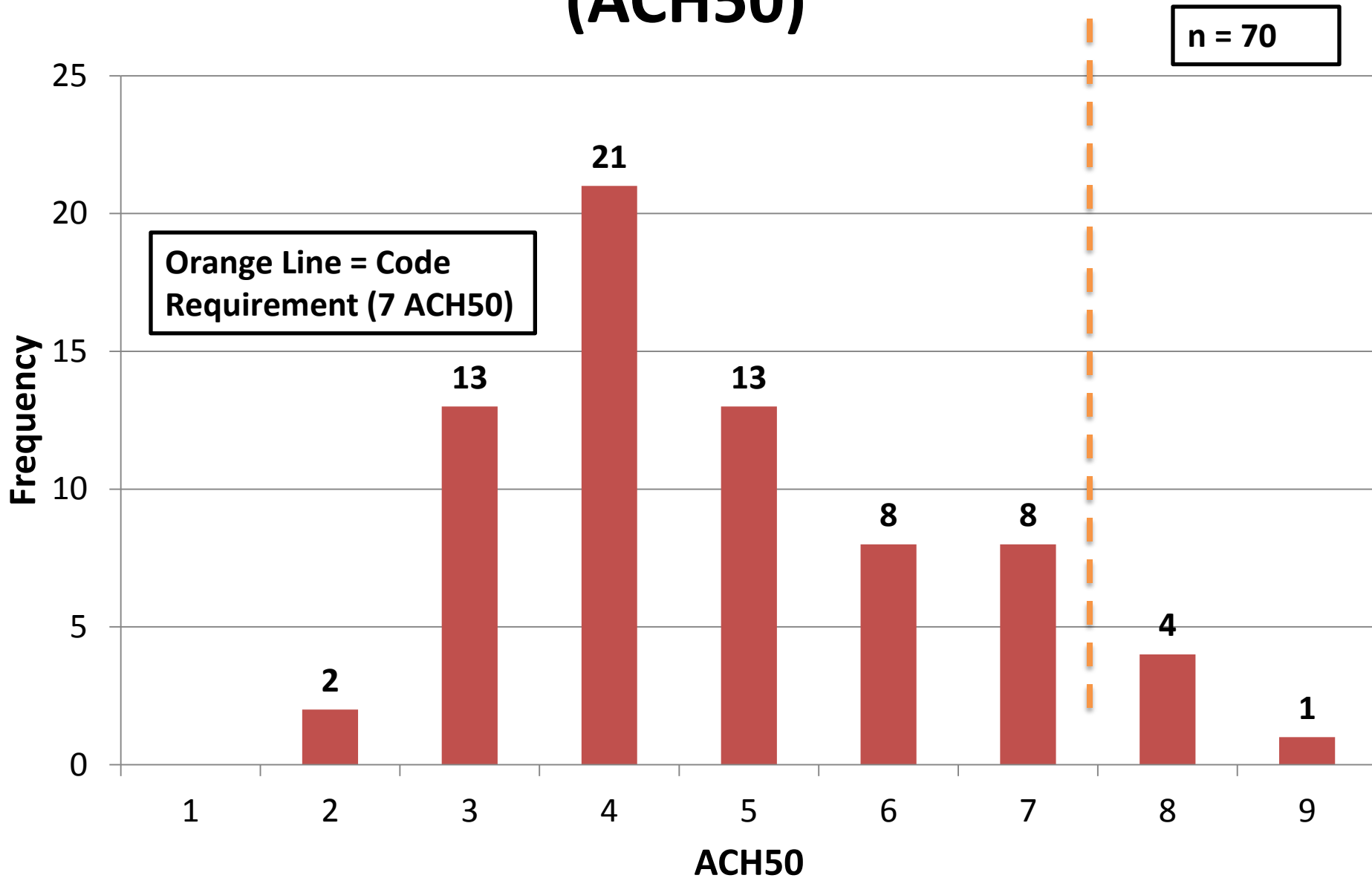
# Pennsylvania - Wall Insulation (R-Value)



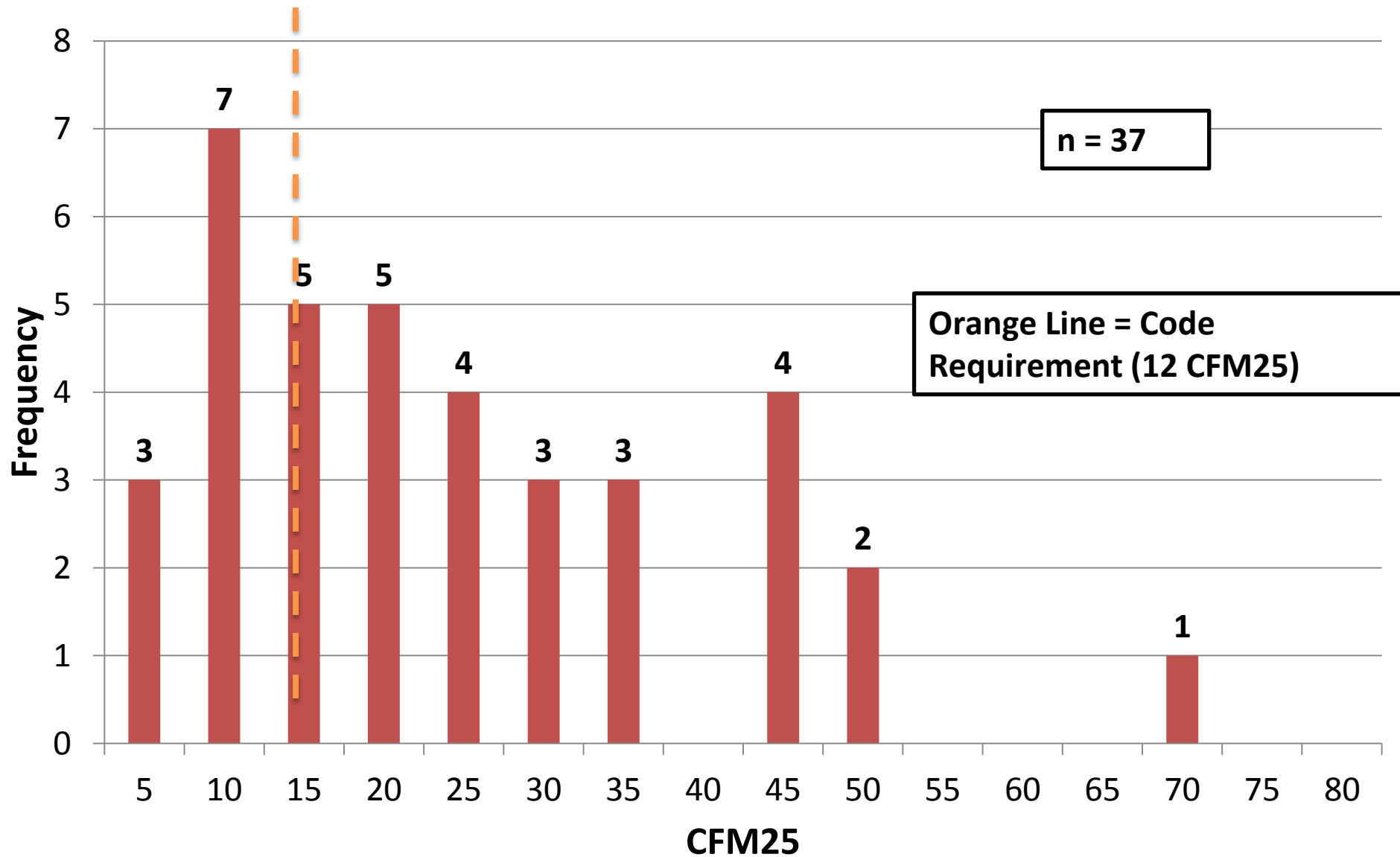
# Pennsylvania Wall Insulation - Quality



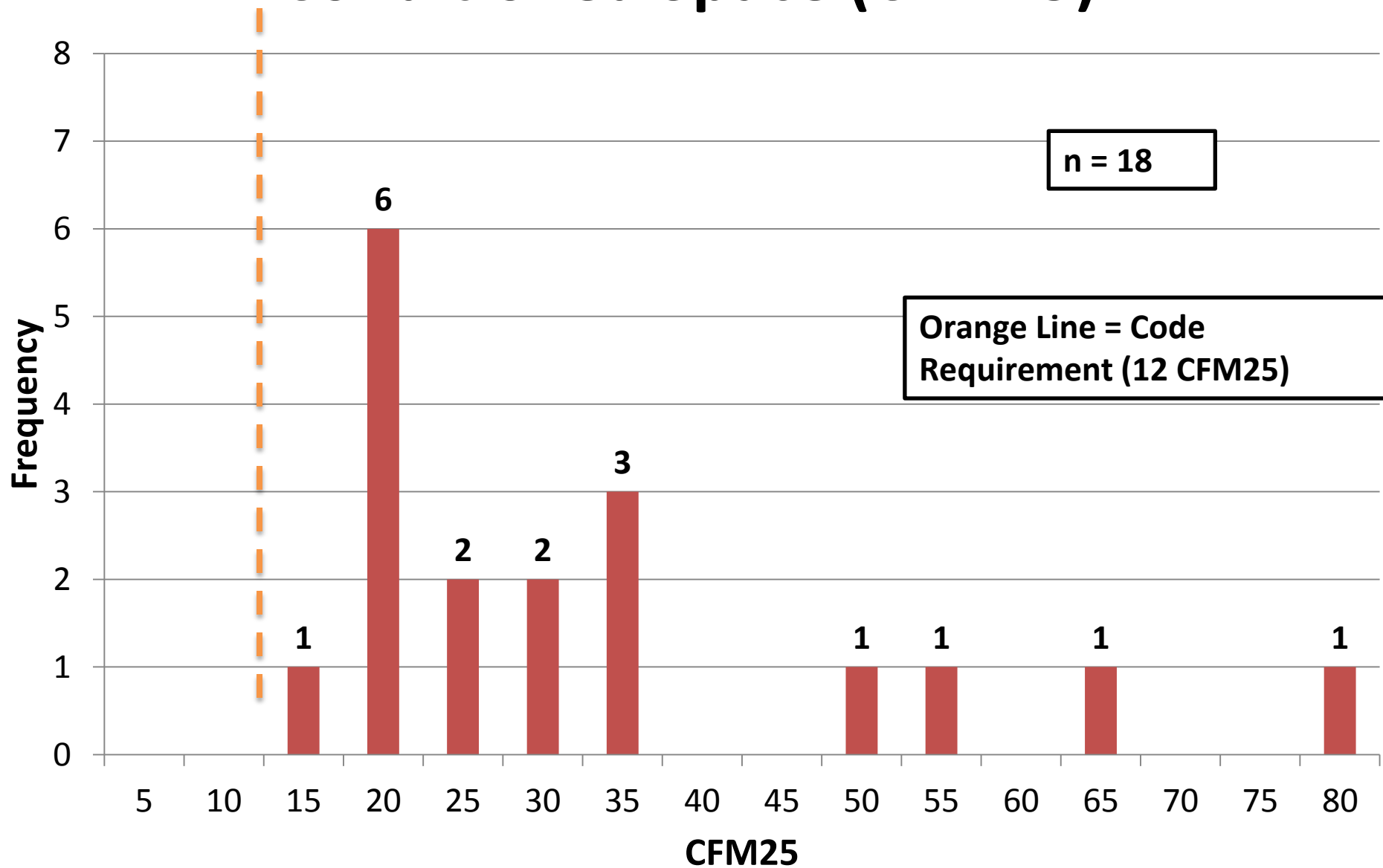
# Pennsylvania Blower Door Results (ACH50)



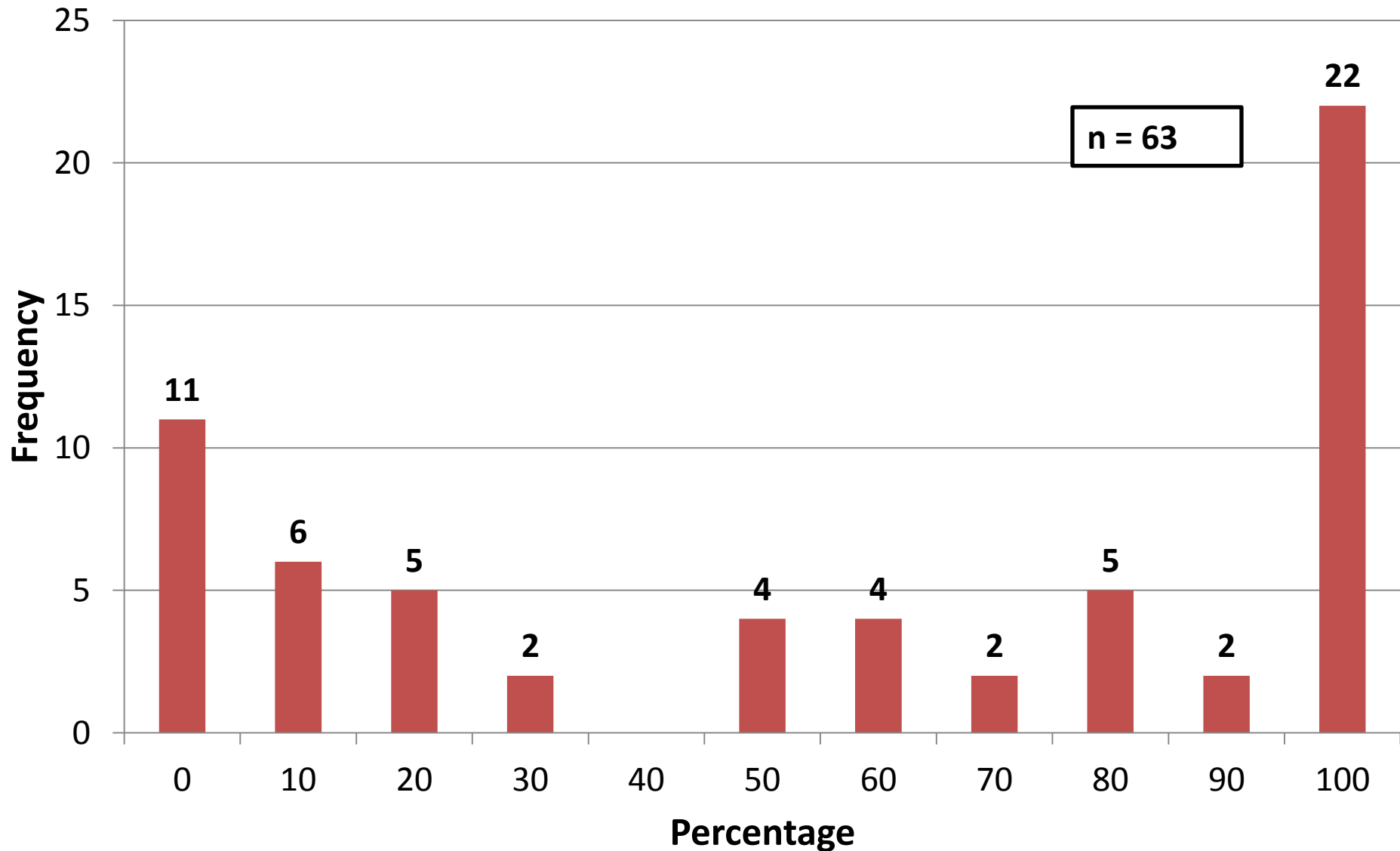
# Pennsylvania Duct Leakage - Unconditioned Space (CFM25)



# Pennsylvania Duct Leakage - Conditioned Space (CFM25)



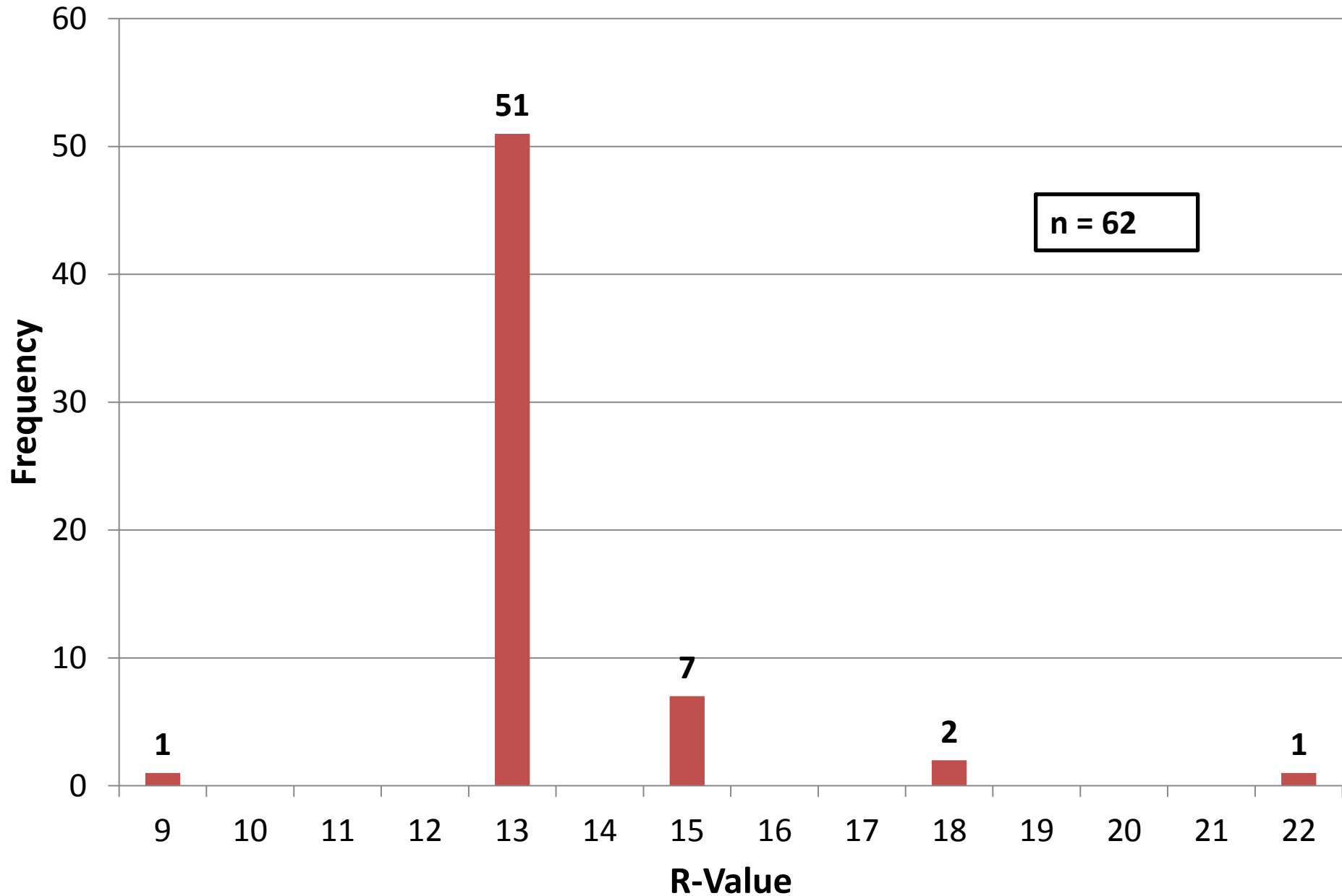
# Pennsylvania - High Efficacy Lighting (%)



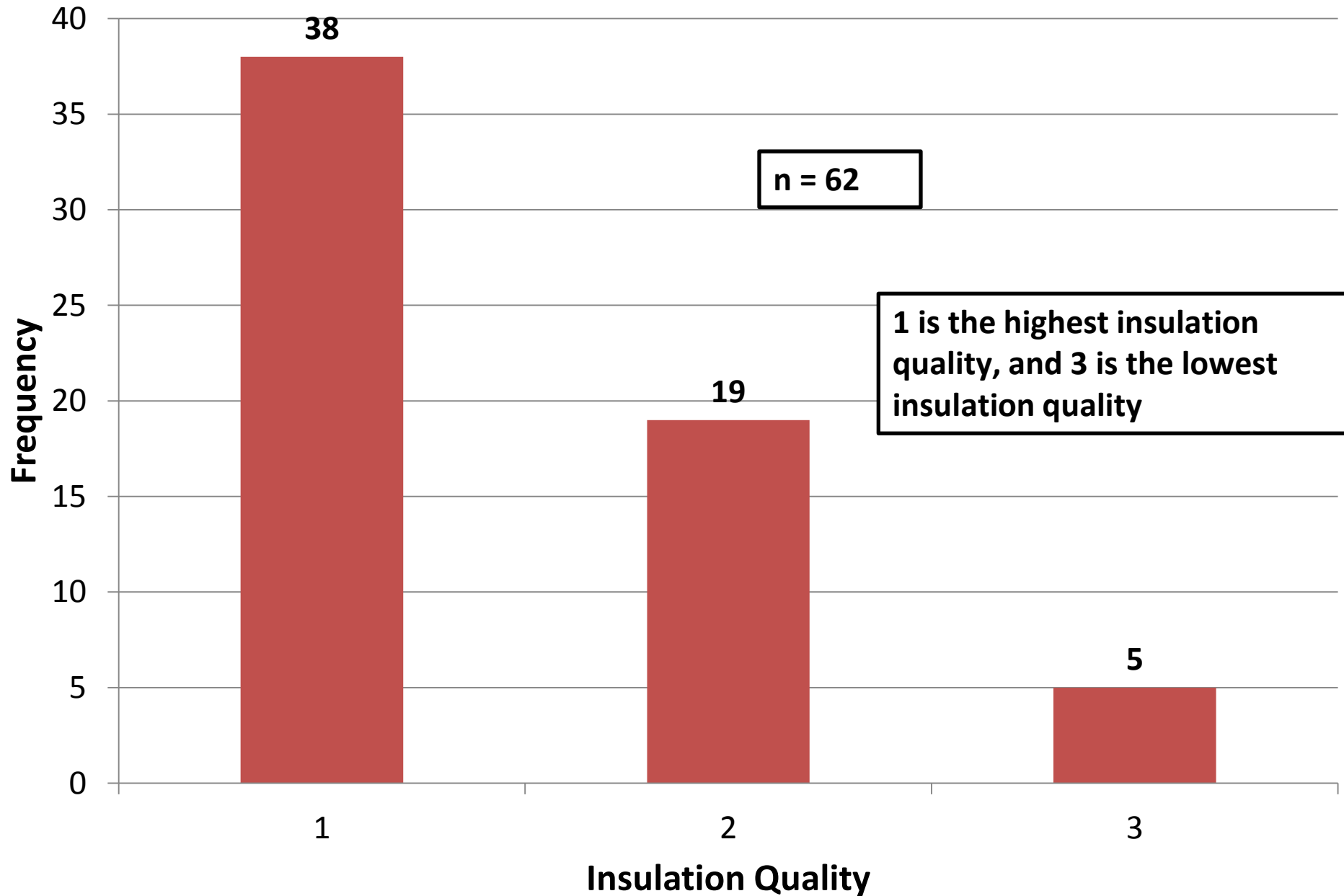
# **Texas Histograms**



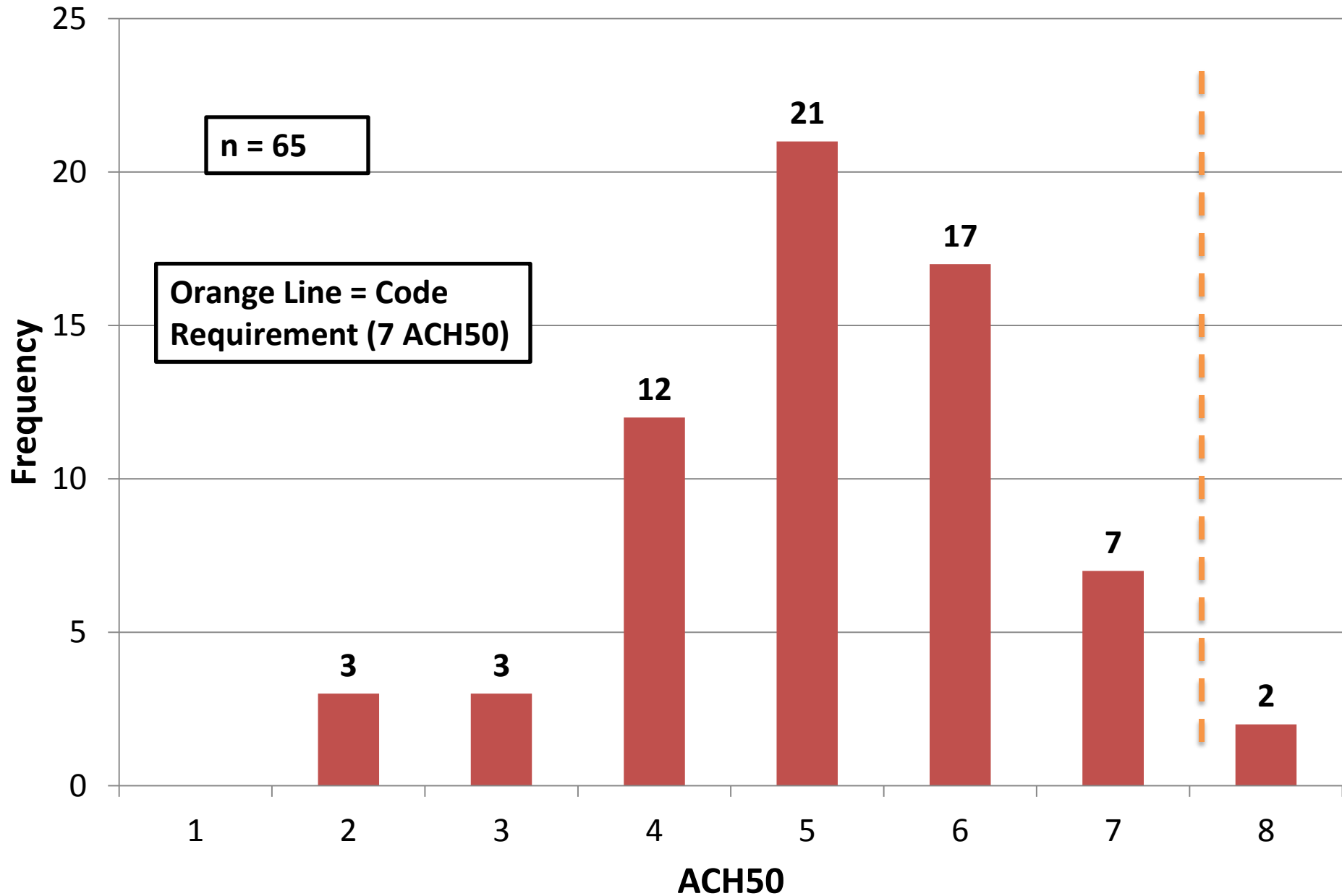
# Texas - Wall Insulation (R-Value)



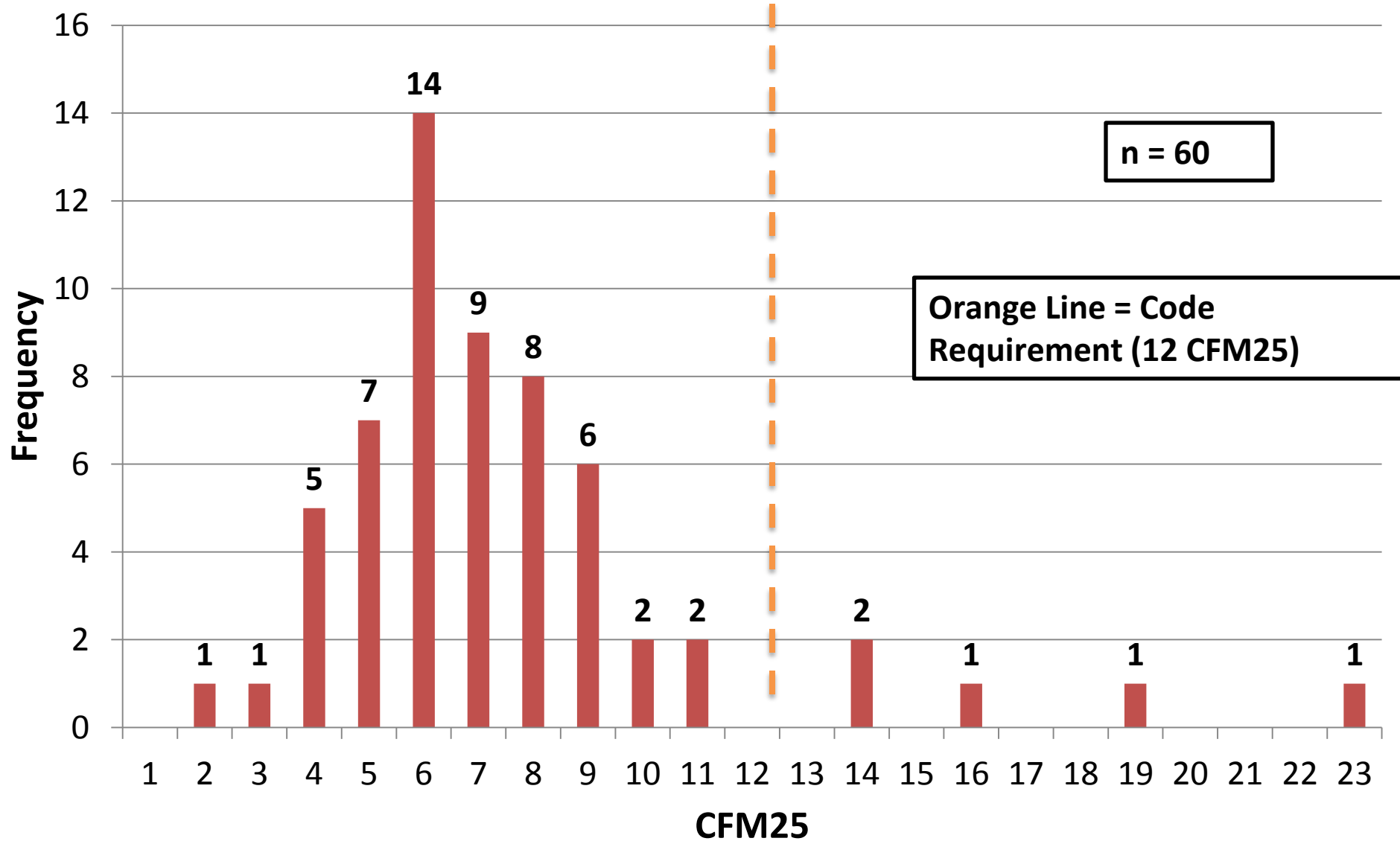
# Texas Wall Insulation - Quality



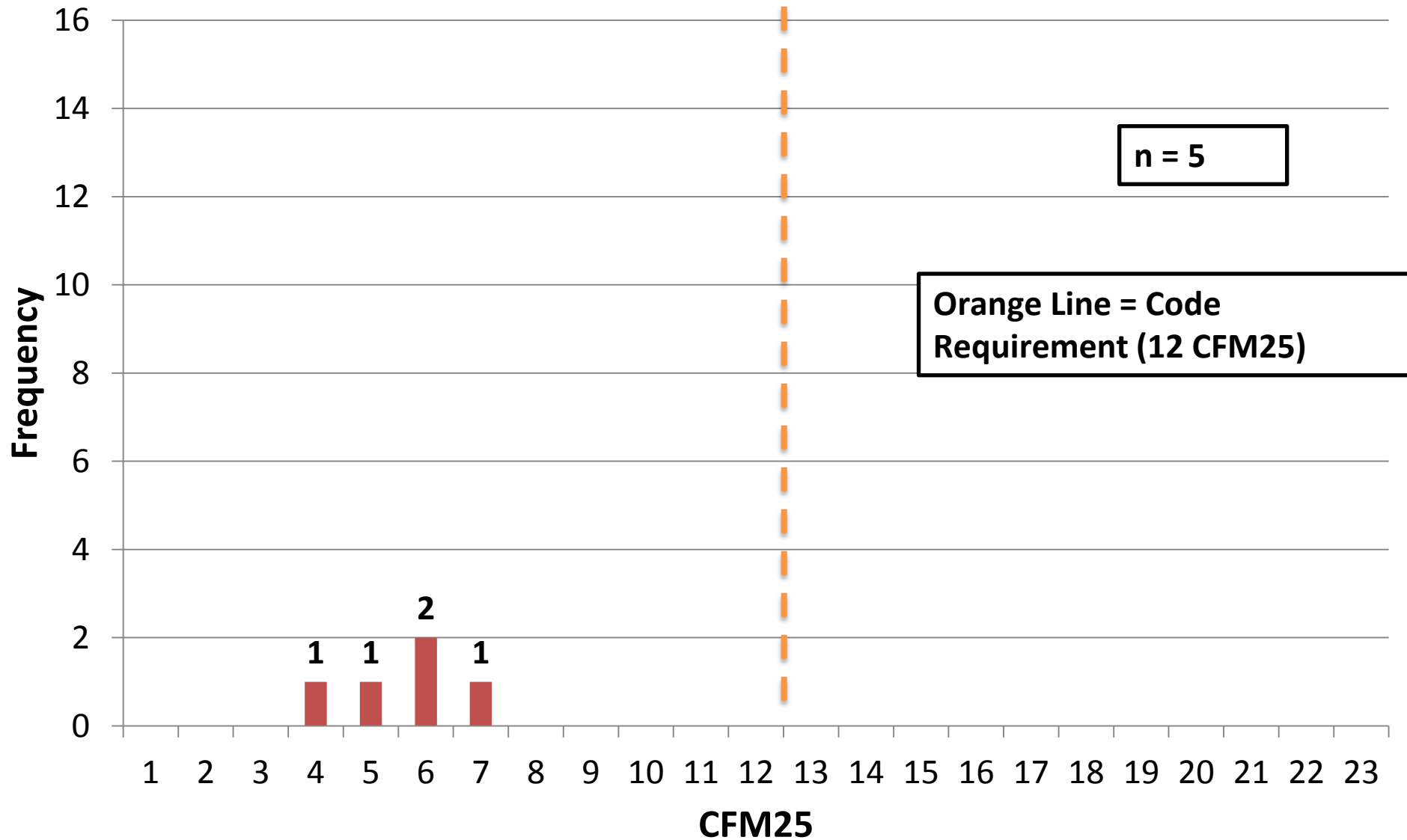
# Texas Blower Door Results (ACH50)



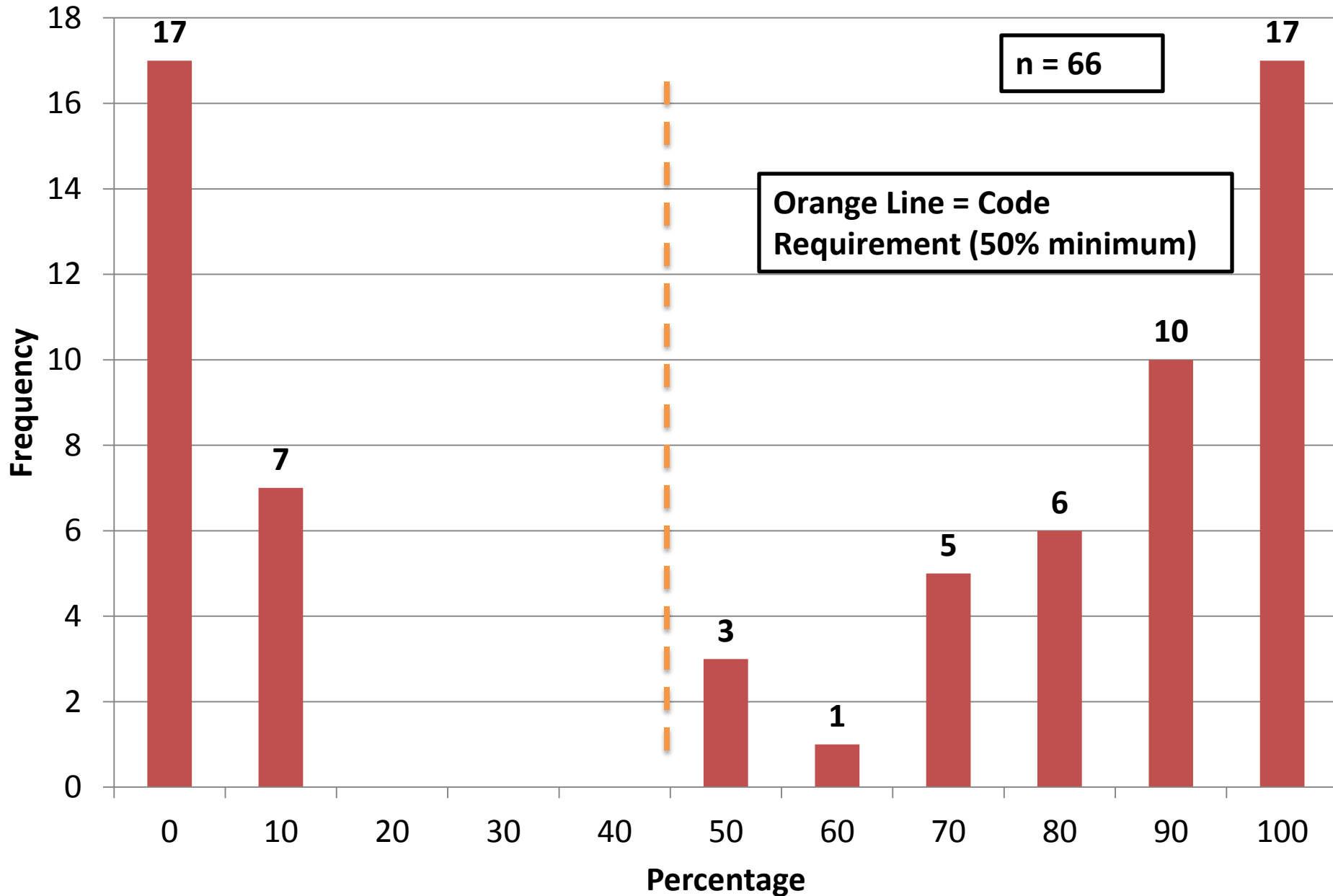
# Texas Duct Leakage - Unconditioned Space (CFM25)



# Texas Duct Leakage - Conditioned Space (CFM25)



# Texas - High-Efficacy Lighting (%)





**MEEA**  
Midwest Energy Efficiency Alliance

# **IOWA HOME ENERGY RATING SYSTEM STUDY PRELIMINARY RESULTS**

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*The Source On Energy Efficiency*

# HERS Data set

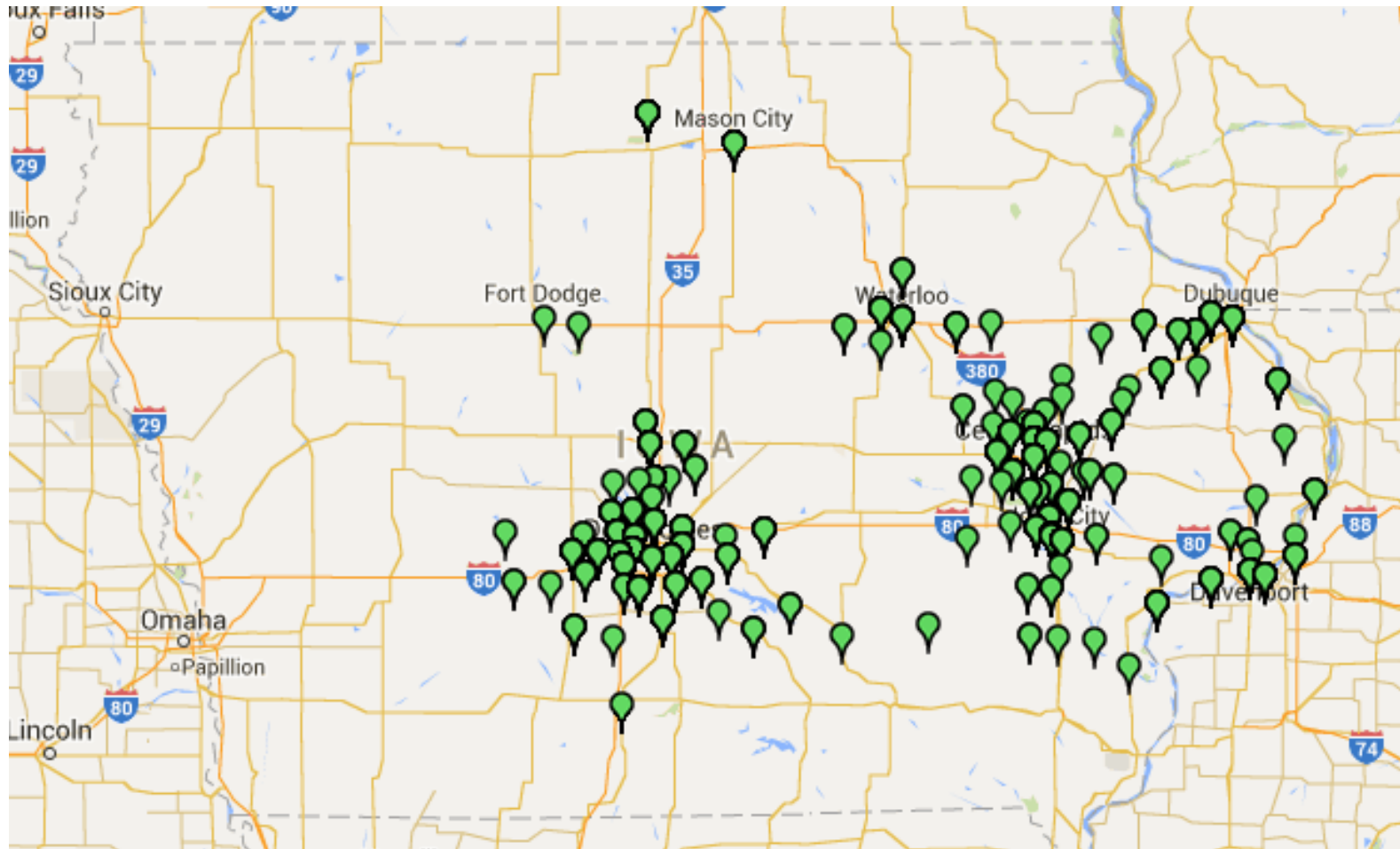
- New Construction
- Home types: Single Family, Duplex, Townhome
- # of homes: ~ 5000
- Average size: 2900\* Sq. Ft. (Conditioned)
- Code Compliance
  - 2009 IECC: ~ 60% of Homes
  - 2012 IECC: ~ 40% of Homes
- Years built: 2009 – 2015
  - 2013: 20% of single-family permits statewide
  - 2014: 28% of single-family permits statewide



# Iowa Code Requirements

- **2009 IECC Amended ~ 60% of Homes**
  - Wall Insulation: R-20
  - Ceiling Insulation: R-38
  - Windows: U - .35
  - Air Sealing: 7 ACH50
  - High Efficacy Lighting: 50%
- **2012 IECC Amended ~ 40% of Homes**
  - Wall Insulation: R-20
  - Ceiling Insulation: R-49
  - Windows: U - .32
  - Air Sealing: 4 ACH50
  - High Efficacy Lighting: 75%

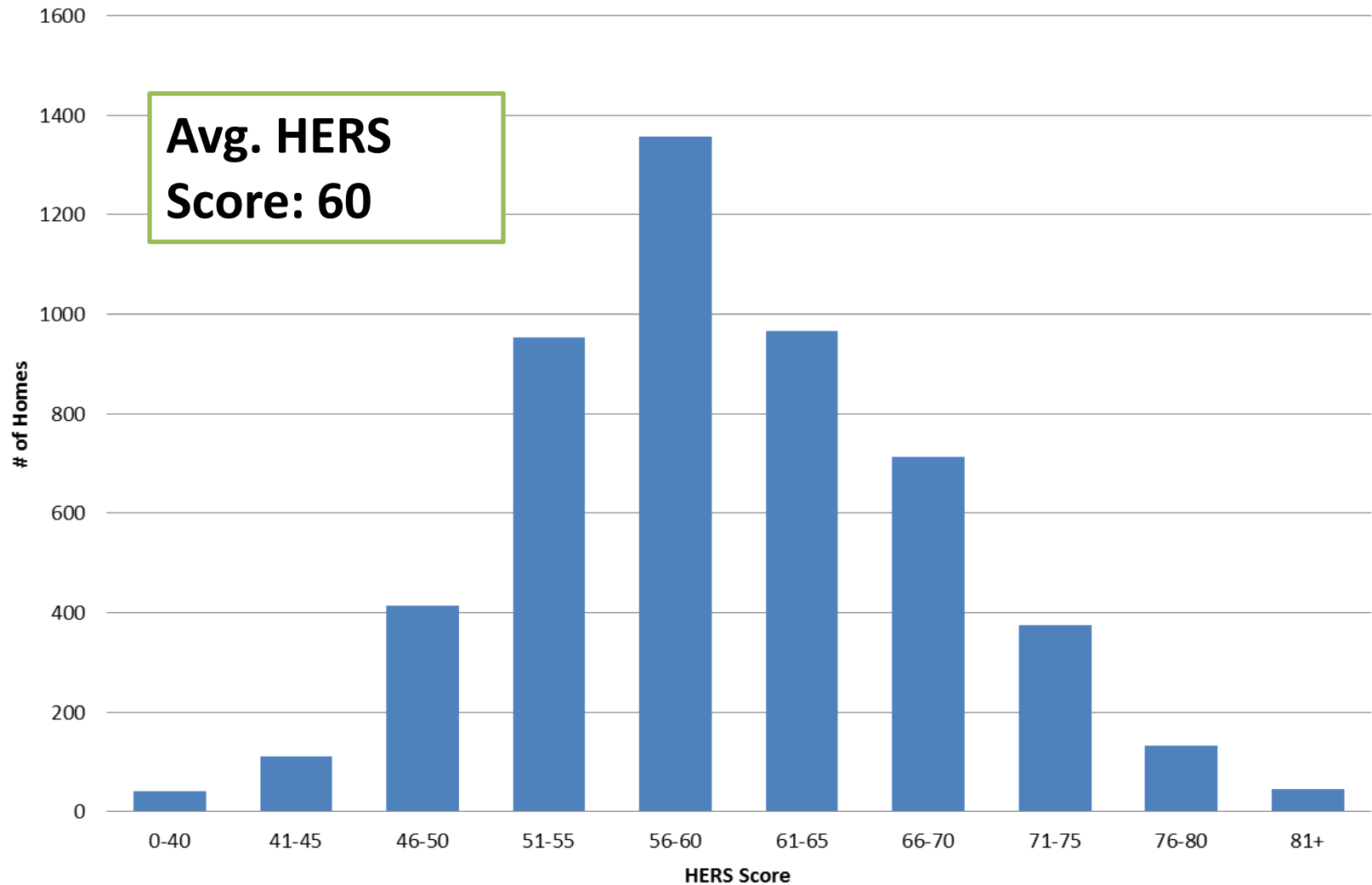
# Map of Homes being studied



# HERS Data set – Home Components

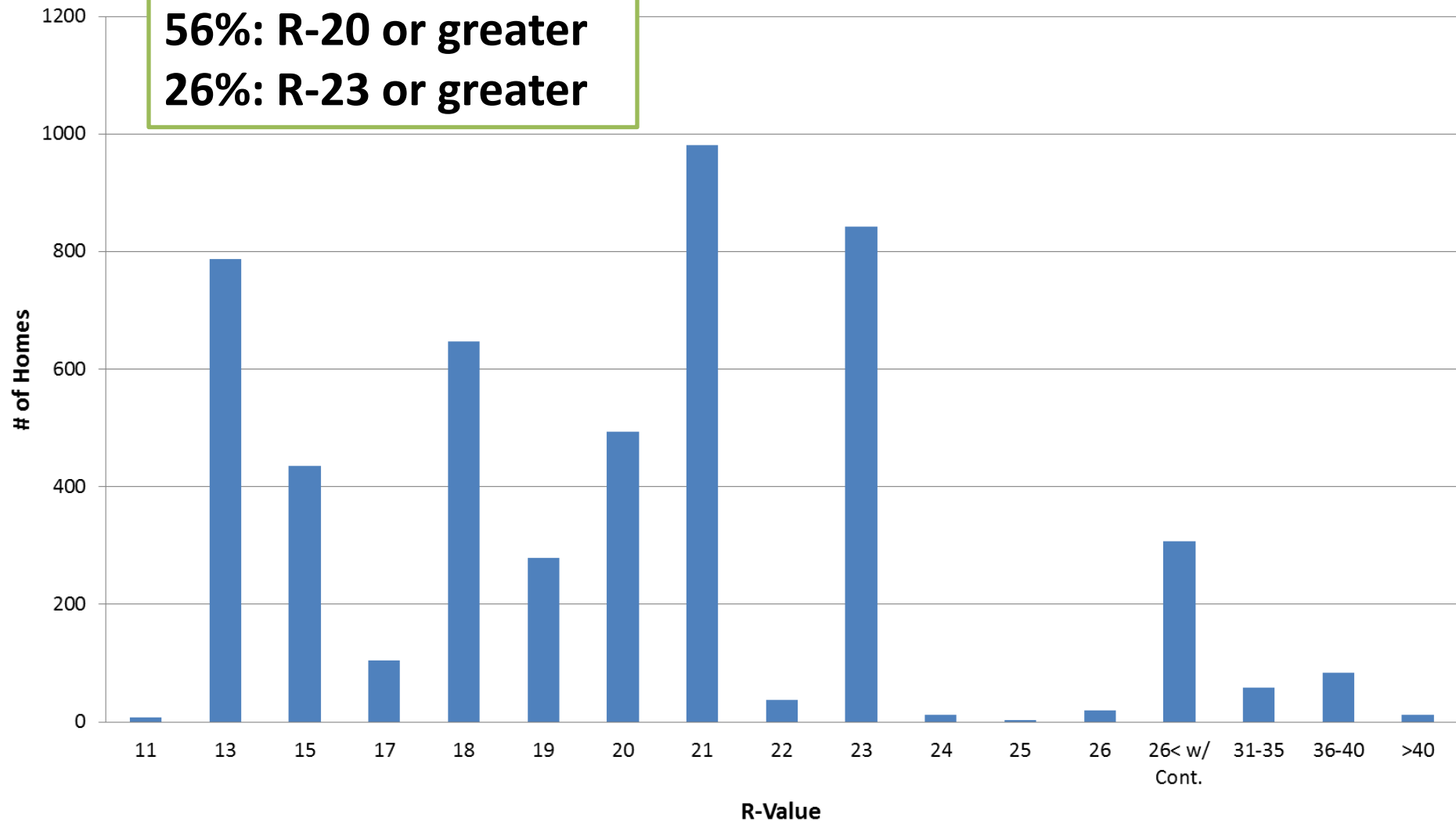
- Wall Insulation – R-Value
- Ceiling Insulation – R-Value
- Windows – U-Factor
- Air Sealing – ACH50
- High Efficacy Lighting - CFL
- AC Efficiency - SEER
- Furnace Efficiency - AFUE

# HERS Scores Iowa

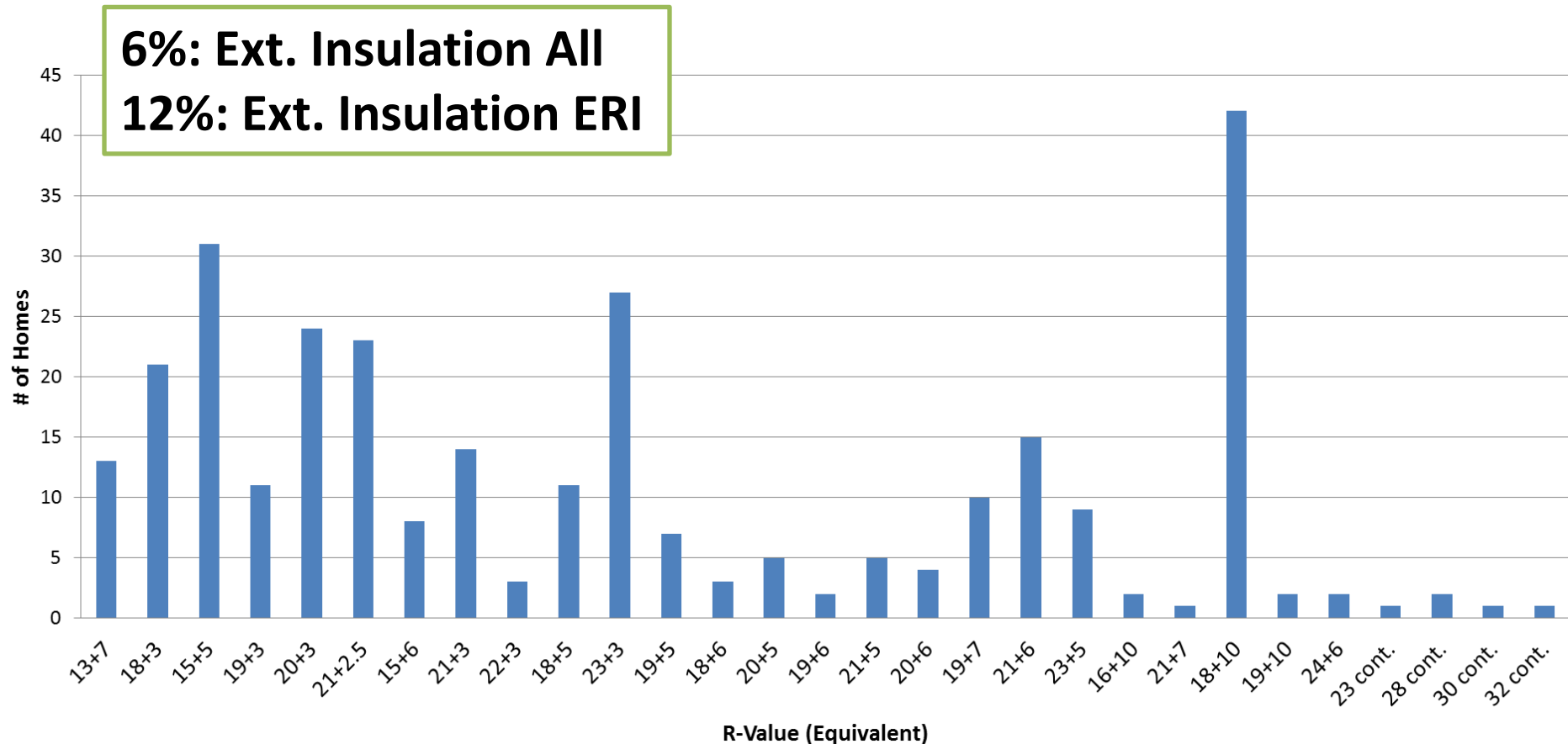


# Above Grade Walls: All Homes

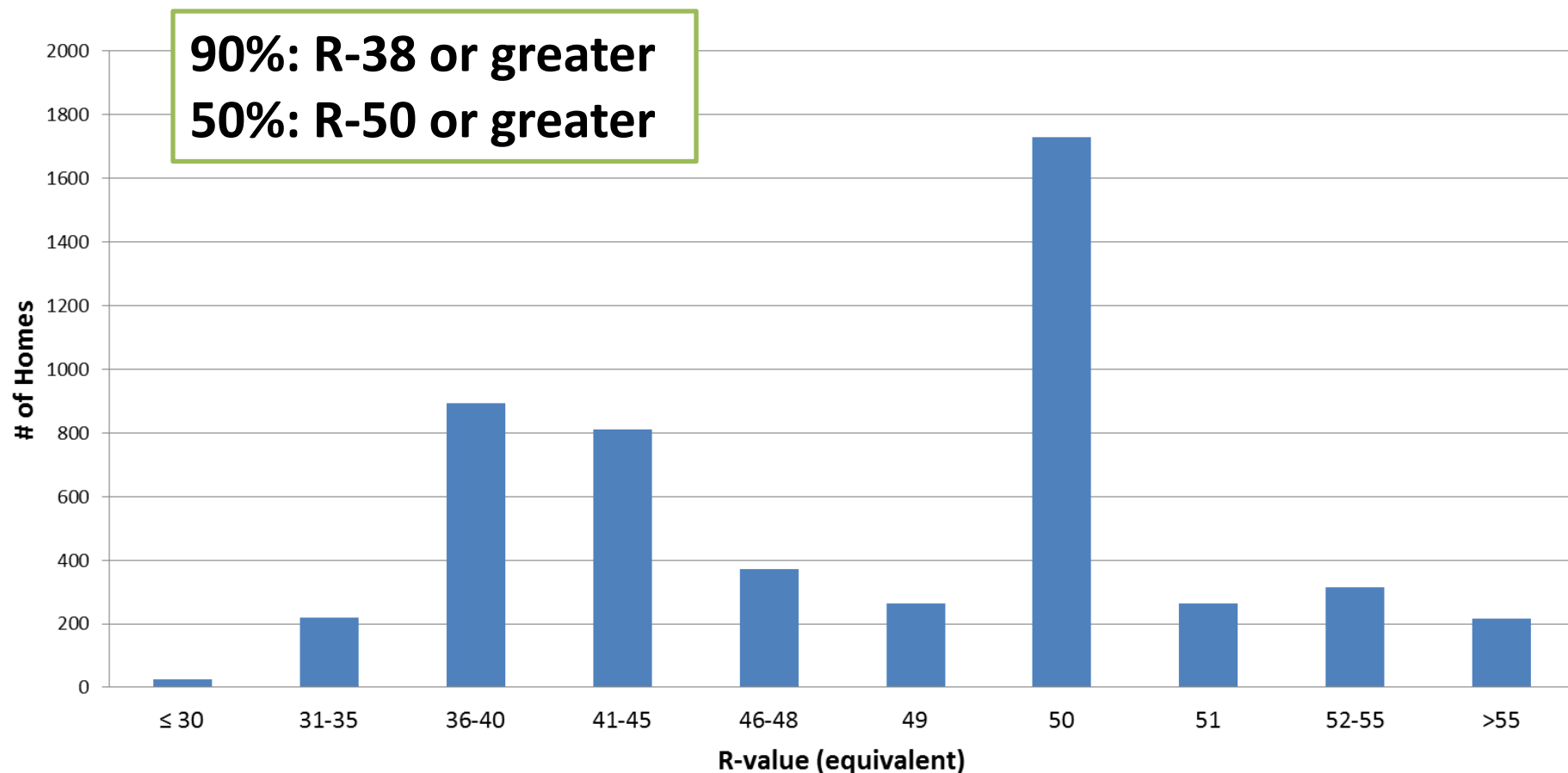
**56%: R-20 or greater**  
**26%: R-23 or greater**



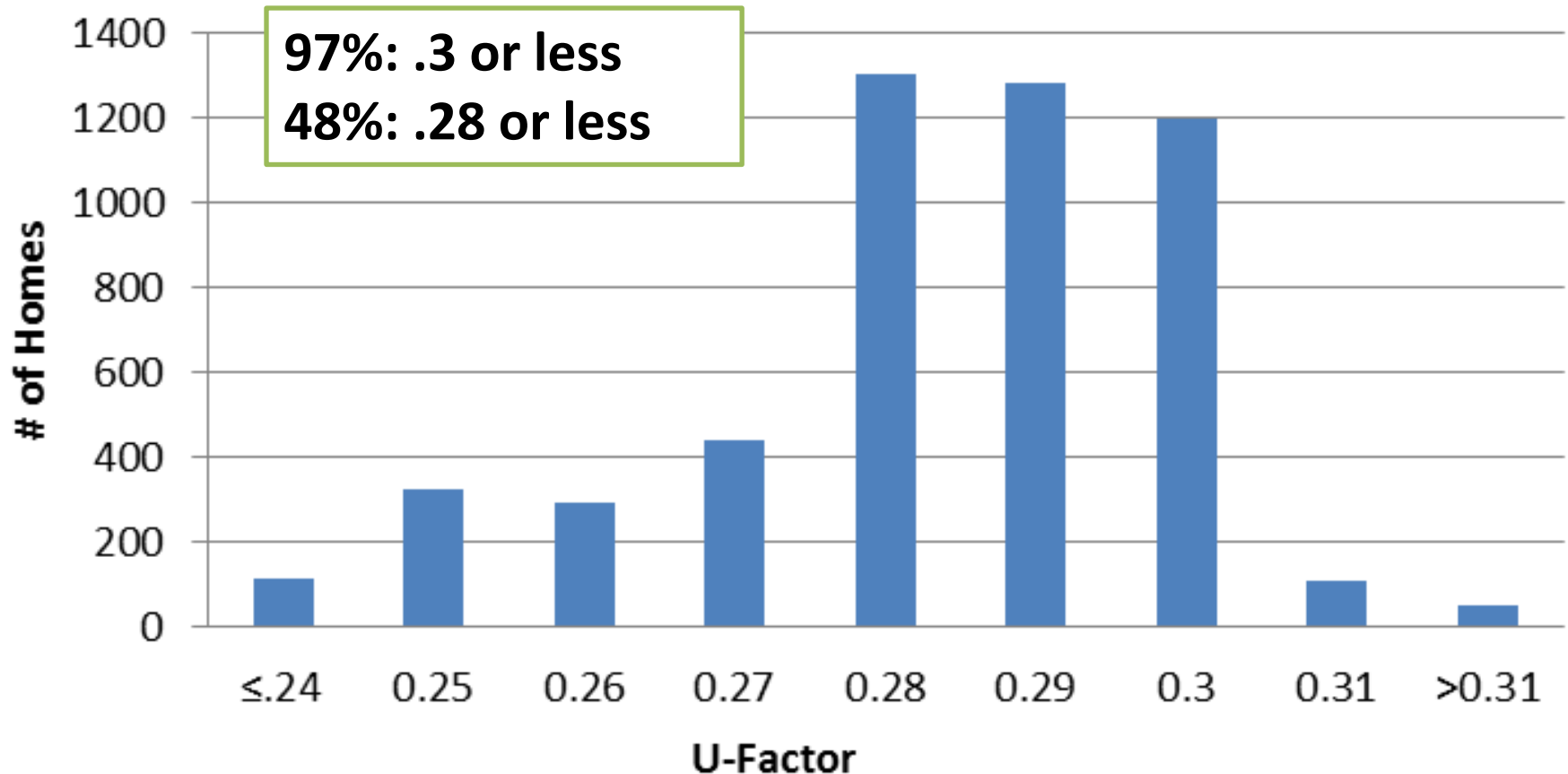
# Above Grade Walls Ext. Insulation: All Homes



# Ceiling Insulation: All Homes

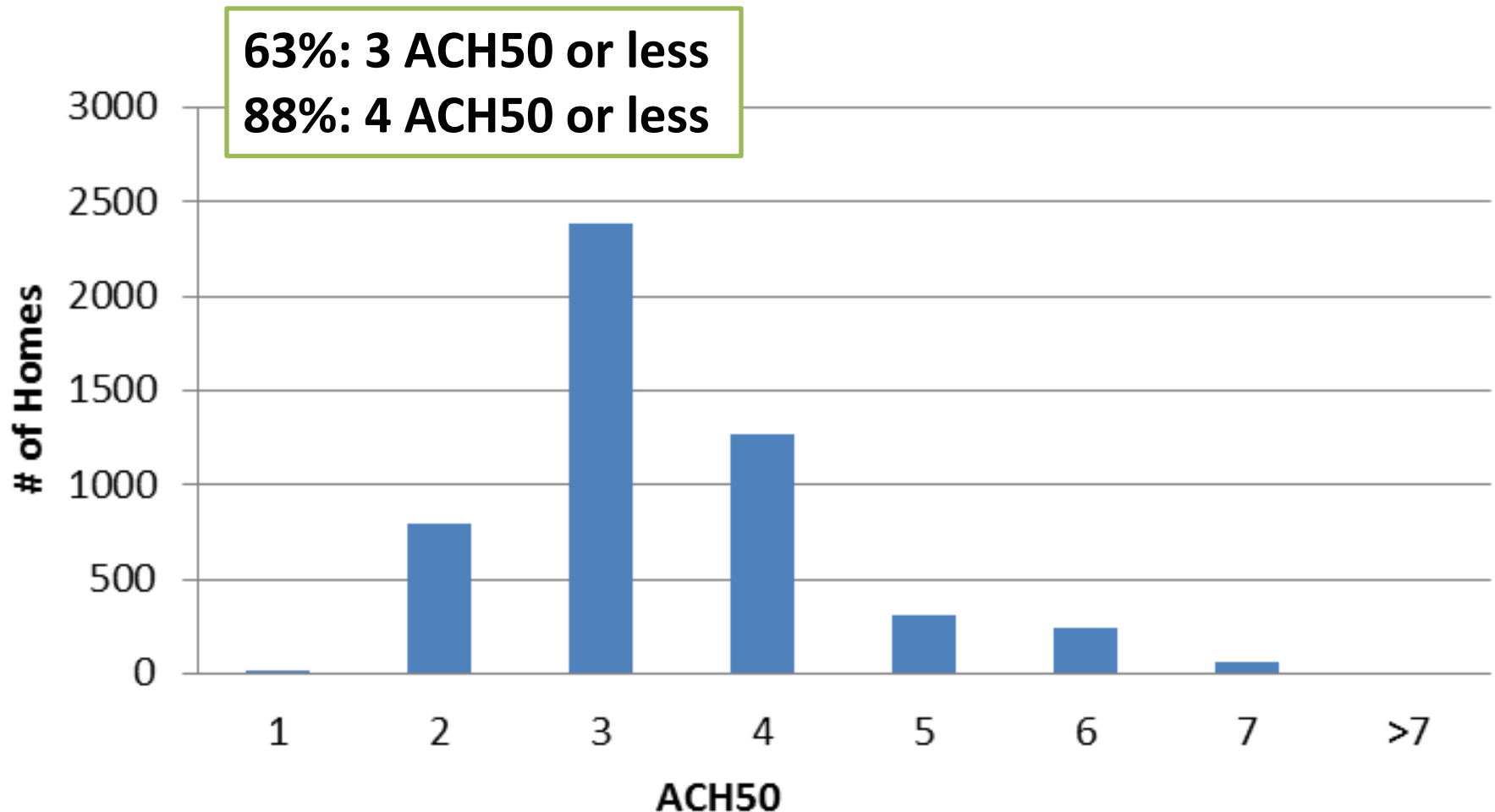


# Windows: All Homes

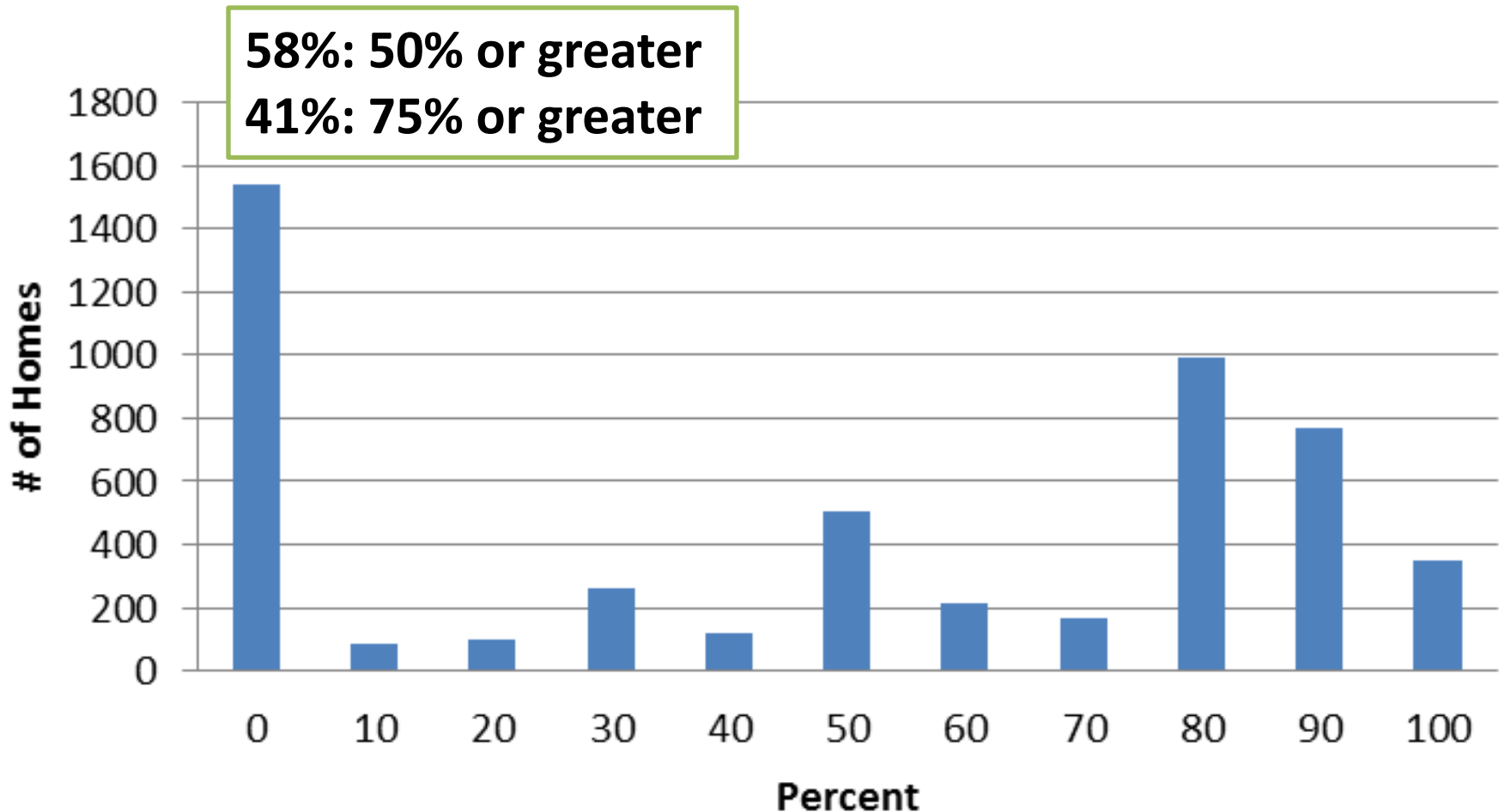




# Distribution of ACH 50: All Homes

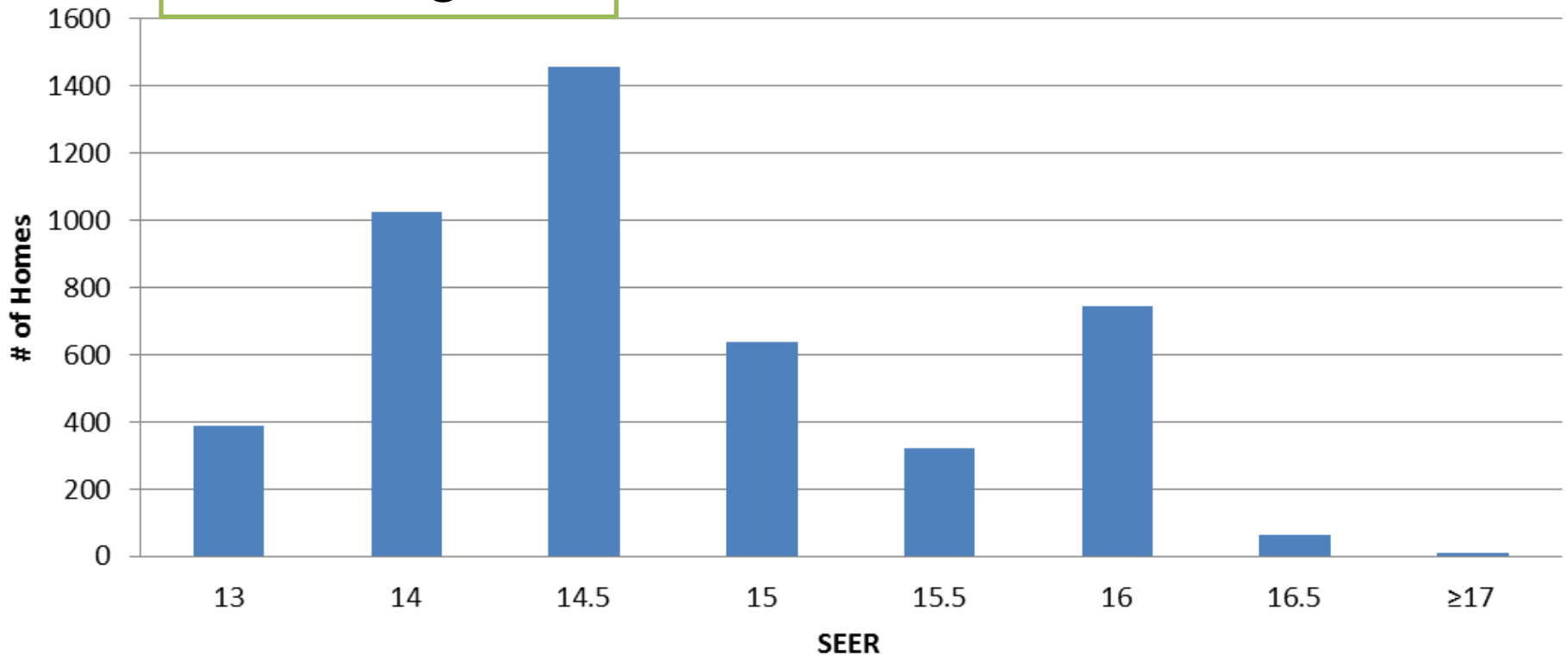


# High Efficacy Lights: All Homes

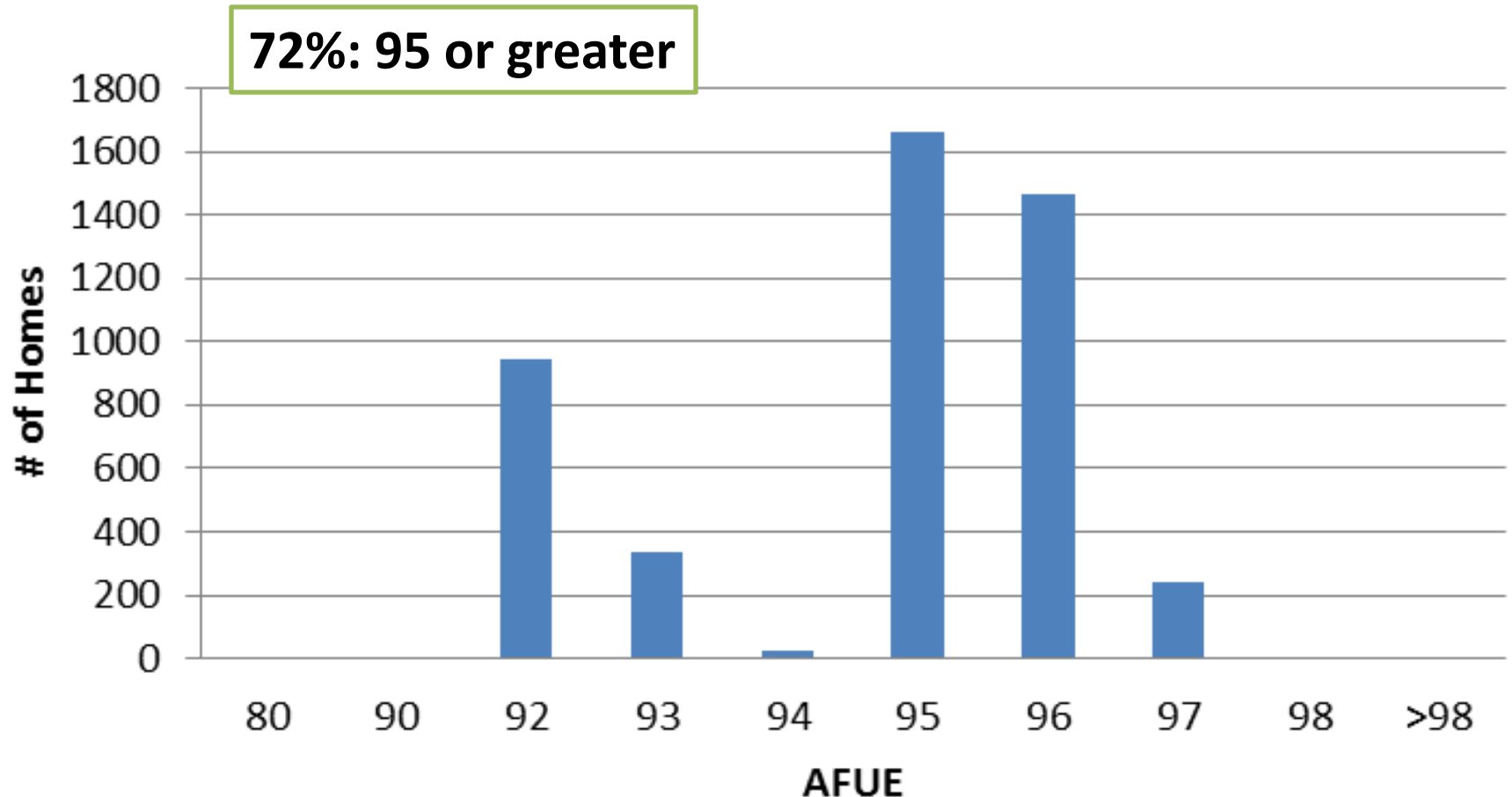


# AC Efficiency: All Homes

**91%: 14 or greater**  
**18%: 16 or greater**



# Furnace Efficiency: All Homes



# MEEA Building Energy Codes Policy

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